THIRTY-SIXTH ANNUAL REPORT

OF THE

STATE DEPARTMENT OF HEALTH

OF

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For the Year Ending December 31, 1915

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Report of Division of Sanitary Engineering

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THIRTY-SIXTH ANNUAL REPORT

OF THE

STATE DEPARTMENT OF HEALTH

STATE OF NEW YORK,

EXECUTIVE CHAMBER,

ALBANY, *February* 26, 1916

To the Legislature:

I have the honor to transmit herewith the thirty-sixth annual report of the State Commissioner of Health for the year 1915.

CHARLES S. WHITMAN

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REPORT OF THE CHIEF ENGINEER

ALBANY, *December* 31, 1915

HERMANN M. BIGGS, M.D. LL.D., *State Commissioner of Health, Albany, N. Y.:*

DEAR SIR.— I have the honor to submit herewith the report of the Division of Sanitary Engineering for 1915.

In my report to you for the year 1914 attention was called to the unusual and marked increments in the volume and extent of the work of the Engineering Division during 1914 and the preceding year and to certain important changes in organization and methods of work employed to meet these increased demands. The volume of work performed during 1915 has in comparison shown an even greater increase over that for 1914, made possible largely through increased force and facilities provided the Division. The methods employed in the execution of the work have not however been modified to any considerable extent since experience has demonstrated that under present exacting requirements and existing limitations of force and facilities as high an efficiency as is practicable is now being attained.

The principal changes that have been made are, first, with reference to the time and services devoted by the Sanitary Supervisors in cooperation with the work of the Engineering Division and, secondly, with reference to the relative proportion of time which the Engineering Division has devoted to investigations of public water supplies and of sewage disposal plants. With reference to the first of these it has been found that the duties of the Sanitary Supervisors have become so extended and exacting in directions other than in engineering that certain work of that nature which had been previously assigned to them has been transferred back to the Engineering Division.

The second and more important change referred to and one which merits perhaps particular notice, was the centering of the activities of the Division to an even greater degree than heretofore on the investigations and follow-up work in relation to public water supplies, and a corresponding diminution of these

activities in the investigation of sewage disposal plants. The accumulated experience of the past few years has so clearly demonstrated the relatively greater value of our work in the water supply field, measured by actual results in terms of lowered typhoid fever rates, as compared with other fields of work, particularly in comparison with sewage disposal, that there can be little doubt as to the wisdom of this change at least in the present stage of progress of health matters in the State. As time elapses a further change in the relative proportion of time and efforts devoted to these two fields of investigation, may, and probably will, be necessitated.

In 1915 there were referred to the Engineering Division some 2,850 pieces of correspondence, each matter referred requiring careful consideration for its proper disposition. In the handling of these matters there were issued 4,250 letters, reports or other communications, ranging from letters of advice on sanitary engineering subjects to extended reports of investigations. A summary of the more important of these is given below:

Sewer plans examined and reported upon	99
Reports submitted to Commissioner	278
Investigations of water supplies	167
Investigations of sanitary conditions of State institutions	32
Investigations of sewage disposal plants	26
Investigations relating to sewerage systems	26
Investigations of cases of stream pollution and public nuisances	84

In addition 396 conferences were held during the year with municipal authorities or with private individuals in connection with various matters before the division or in regard to questions where advice was desired and twenty-nine lectures and addresses on sanitary engineering subjects were delivered by the chief engineer or other member of the staff at public meetings or in educational work.

A progress chart showing graphically the work of the Engineering Division during the past ten years, 1907–1916, or since the year following its establishment, is herewith presented. The volume of work by months, according to its classification along

lines which indicate its main extent, is here shown and by means of this chart the monthly and seasonal variation in the routine work during this period may be seen at a glance. It is of interest to note the increased volume of work which has been possible during the past two years by reason of the increased membership of the staff.

In the following pages are presented various reports and other matter indicating and presenting in large part the work of the Engineering Division, this material being arranged and indexed in accordance with the classification uniformly adopted for all records in the Division and is the same as that used in previous annual reports.

Respectfully submitted,

THEODORE HORTON

Chief Engineer

SEWERAGE AND SEWAGE DISPOSAL

EXAMINATION AND APPROVAL OF PLANS FOR SEWERAGE AND SEWAGE DISPOSAL

The Public Health, Village and Town Laws require generally that all plans for sewerage and sewage disposal shall be submitted to and approved by the State Commissioner of Health before they be constructed and put in operation. The Public Health Law also provides that no sewage, factory wastes or other refuse shall be discharged into the waters of the State unless permission be granted by the State Commissioner of Health. The work which the Engineering Division is called upon to perform under these provisions of the law with reference to the approval of plans for sewerage and sewage disposal and the issuance of permits, comprises one of the most important of its routine duties.

In the examination of plans for systems of sewerage and sewage disposal for municipalities submitted for approval careful consideration is given to details of the design, the efficiency and adequacy of the systems as a whole, the degree of treatment of the sewage provided for, the location of the proposed point or points of discharge not only with respect to the municipalities themselves but also to adjacent communities, the nature of the body of water to receive the sewage or sewage effluent, and other questions of a sanitary and hydraulic nature. Although plans are usually not called for in connection with applications for the discharge of industrial wastes or effluents, all such applications are carefully considered with special reference to the possible creation of nuisances before permits allowing such discharge are granted.

During the past year some ninety-nine sets of plans for sewerage and sewage disposal were examined and reported upon, and the estimated cost of construction represented by these plans is about $2,000,000. Plans for sewers, sewer systems and sewage disposal works were approved in the cases of the following places during 1915:

ALBANY

HERMANN M. BIGGS, M.D., *State Commissioner of Heauth:*

Plans for pumping stations and grit chamber to be constructed in connection with the intercepting sewer and sewage disposal works of the city of Albany were submitted to this Department for approval on July 15, 1915.

A report of the Designing Engineers on the design of the plans was received on July 27, 1915.

The records of the Department show that general plans for a proposed intercepting sewer and detailed plans for sewage disposal works to care for the dry weather flow of sewage of the city of Albany were approved on January 15, 1913. On March 18, 1914, detailed plans for the intercepting sewer and appurtenances together with general plans for pumping stations and grit chamber and plans for the interception of the sewage now discharging into Patroon's creek were approved. The city authorities were advised at the time of the approval of the latter plans that detailed plans for the pumping stations and grit chamber should be submitted to this Department for approval before their construction is undertaken.

The plans now presented and under consideration were prepared by Hering & Gregory, Consulting Engineers of New York city, and were submitted in accordance with the above requirements. These plans show details of the pumping stations serving North Albany and of the gate chamber, grit chamber, and main pumping station on Westerlo Island.

Patroon's creek pumping station

The so-called Patroon's creek pumping station in the northern part of the city is to be located at the site shown by the plans for the intercepting sewer approved on March 18, 1914. It is to be placed near the intersection of Manor street and Broadway and is to serve North Albany, which is too low to be tributary to the intercepting sewer by gravity. The dry weather flow of sewage from that portion of the city is to be pumped into the upper end of the intercepting sewer.

The pumping station is to be equipped with two 8-inch centrifugal pumps having a capacity of 1,500,000 gallons per day each. The pumps are to be driven by automatically operated electric motors and will discharge the sewage into the intercepting sewer against a head of about fifteen feet.

Main or Westerlo island pumping station

The entire dry weather flow of sewage of the city before reaching the main pumping station on Westerlo Island will be passed through a gate house, bar screen and grit chamber before reaching the pumping station.

Gate House.—The gate house, which is to be located at the end of the intercepting sewer west of the grit chamber and pumping station, is to be provided with a 54-inch sluice gate by means of which the entire flow of sewage, in case of emergency, may be shut off from the pumping station and discharged into the river through the various storm-water overflows located along the line of the intercepting sewer, or the gate may be closed during floods should the regulators along the intercepting sewer fail to keep the river water out of the intercepting sewer. The sluice gate may be operated by motor or by hand and may also be electrically-controlled from the pumping station, where an electric device will indicate the position of the gate.

Screen.— The sewage after passing through the gate house will be passed through an inclined bar screen at the head of the grit chamber. This screen is to be 10 feet wide and is to be composed of bars spaced 2 inches in the clear.

Grit chamber.—After passing through the screen the sewage is to flow through a grit chamber. This chamber is to be divided into two parallel compartments and is to be provided with stop planks so arranged as to permit of using either or both compartments at one time. Each compartment is to be 60 feet long and will have a cross section below the maximum flow line of about 55 square feet. The average velocity through one of the compartments will be about one foot per second and the detention period about one minute with a flow of 30,000,000 gallons per day, which is the basis of design of the disposal plant.

The grit from the chamber is to be removed by a clam-shell bucket operated from an electric locomotive crane which will discharge the grit into tip cars

on the track adjacent to the grit chamber. The grit may also be removed from the grit chamber by shoveling out the grit by hand after shutting off the flow from one of the compartments and draining the sewage into the pumping station.

Pump station.— From the grit chamber the sewage will be discharged into a suction conduit leading to the suction well of the pumping station. This station is to be a circular brick building resting on a concrete substructure 62 feet in diameter and 42½ feet deep, inside dimensions. The suction well is 10 feet wide and surrounds a dry pump well 38 feet in diameter. The capacity of the suction well is equal to the flow of about five minutes, so that there will be practically no storage of the sewage.

The pumping station is to be equipped with three 10,000,000 gallon vertical centrifugal pumps driven by 2,200 volt A. C. motors, three 15,000,000 gallon vertical centrifugal pumps driven by 575 volt D. C. motors, and two 200 K. W. 2,200 A. C. to 575 D. C. motor generator sets to generate direct current for the direct current motor operated centrifugal pumps and the locomotive crane. A master control is also to be provided to automatically care for the variation of the flow of the sewage. This controller is designed to start, speed up, slow down or stop any or all of the pumps so that the rate of pumping will automatically vary with the rate of flow of sewage. The pumps may also be operated manually.

It is planned to have the A. C. pumps handle the average daily flow and to have the D. C. pumps care for the variation in the flow. The pumping equipment, according to the report of the designing engineers is designed to care for a range of flow of from 10,000,000 gallons to 60,000,000 gallons per day. As noted in the report on the examination of plans for the interception and disposal of the sewage, approved on January 15, 1913, the disposal plant is designed to care for a flow of 30,000,000 gallons per day, and the intercepting sewer for a future flow of 60,000,000 gallons. Provisions are made in the construction of the force main near the plant for the future extension of the disposal plant.

From our examination of the plans it is found that the proposed pumping stations if properly constructed in accordance with the plans and if operated with care and efficiency should satisfactorily meet the requirements for which they are designed, and I would therefore recommend that the plans be approved.

Respectfully submitted,

THEODORE HORTON,
Chief Engineer

ALBANY, N. Y., *August* 11, 1915

The plans were approved on August 20, 1915, in accordance with the above recommendation.

ALDEN (Erie County Farm)

HERMANN M. BIGGS, M.D., *State Commissioner of Heauth:*

Plans for sewage disposal for the Erie County Farm were submitted to this Department for approval by the Chairman of the Board of Supervisors on February 3, 1915.

The farm, which has an area of 450 acres, is located along Ellicott creek, in the town of Alden, near the Wende station of the New York Central & Hudson River railroad. It appears from the report of the Designing Engineers that the farm was purchased in 1909 by the county of Erie with the view of establishing a county almshouse on the farm, but until 1914, at which time the Board of Supervisors adopted the policy of employing convicts from the Erie county penitentiary for the purpose of cultivating land, nothing was done with the property. At present a detention building which will house about 200 convicts is being constructed by the prisoners. It is stated in the Engineer's report that the proposed sewage disposal plant

has been designed to care for the population of 500 and that it will serve the newly constructed detention house and other buildings which are either proposed or in the course of construction. No statement is submitted, however, as to the basis for making the estimate as to the future population to be served by the plant and only one sewer leading from the detention house to the disposal plant is shown by the plans.

The proposed plant, which is to consist of a screen chamber, settling tank, sprinkling filter and sludge drying bed, is planned to be located about 400 feet south of the detention house and about 200 feet from the Wende road. It appears from the general plan of the property that the topography is such as to permit of placing this plant at a greater distance from the detention house and the road and I am of the opinion that if possible a plant of this type should be located as far from the highway and buildings as possible.

The proposed sewer from the detention house to the disposal plant is to be 6 inches in diameter and is designed with a slope of .4 per cent. The proposed slope is not sufficiently steep to provide self-cleansing velocities in a sewer of this size. The sewer should either be increased in size to 8 inches in diameter or the slope of the proposed sewer should be increased to .6 per cent.

The sewage upon reaching the disposal plant is to be passed through a small screen chamber 6 feet long, 2½ feet wide and 1 foot 10 inches deep, in which is to be placed an inclined bar screen 2½ feet wide. The details of the screen are not shown, so that it is not possible to determine the spacing of the bars. The bars forming the screens should be not less than 1 inch apart in the clear. The outlet channel from the screen chamber is provided with a two-way valve by means of which the sewage from the chamber may be discharged into either end of the proposed settling tank, thereby providing for a reversal of flow of the sewage through the tank. The reversal of flow through the tank does not appear to be necessary, inasmuch as the tank is designed with only one sludge compartment.

The proposed settling tank is to be a horizontal flow tank of the Imhoff type, 21 feet long, 12 feet wide, with a maximum depth below the flow line of 14½ feet inside dimensions. It is to be divided by means of reinforced concrete partitions into a single upper settling compartment and a single lower sludge compartment provided with hopper-shaped bottom. The settling compartment or settling channel is to be 21 feet long, 8 feet wide and 8½ feet deep from the flow line to the slot between the settling chamber and the sludge chamber, and will give an average time of detention of about 4½ hours when serving a population of 500 persons, assuming a per capita rate of sewage contribution of 100 gallons per day.

The partitions forming the bottom of the settling compartment have been designed with rather flat slopes. One of the partitions is shown with a slope of 1 vertical to 1½ horizontal and the other with a slope of 1 vertical to 1.2 horizontal. These slopes are too flat to prevent solids or sludge from settling on the bottom of the settling channel. The slopes of these partitions should be increased to not less than 1.2 vertical to 1 horizontal. This additional slope, it would seem, could readily be obtained without decreasing appreciably the capacity of the settling compartment by raising the angle point between the vertical and sloping partitions.

The sludge decomposing chamber located below the settling chamber has sufficient capacity to provide for the storage of sludge from the sewage contributed by a population of 500 for a period of some six months. It is planned to remove the sludge and discharge it by gravity flow to an adjacent sludge bed through a 4-inch cast-iron sludge pipe, which is to extend to a point near the bottom of the sludge hopper. A 1-inch pressure water line extending to the bottom of the hopper is to be installed for the purpose of loosening the sludge if necessary and thus facilitating its removal. I am of the opinion that the sludge pipe is too small to prevent clogging and that it should be increased in size to not less than 6 inches in diameter. The pipe should also be extended on a straight line to the surface of the ground and the valve controlling the discharge of the sludge should be on a branch

line leading from the sludge pipe to the sludge bed in order to facilitate cleaning and inspection of the pipe.

The sludge bed, which is to be located near the settling tank is to be 10 feet by 20 feet in plan. The bed is to be underdrained and the filtering material is to consist of a bottom layer of gravel 12 inches deep and a top layer of sand from 12 to 18 inches in depth.

The effluent from the settling tank is to be discharged into a rectangular dosing tank provided with a 5-inch automatic discharge siphon, by means of which the sewage is to be discharged into the distributing system of the sprinkling filter under heads varying from 7 feet to 2 feet. The dosing tank has a capacity of about 25 minutes flow when serving the ultimate population.

The sprinkling filter is to be rectangular in plan and is to be filled to an average depth of 4¾ feet with gravel ranging in size from 1 to 2½ inches. The filter will have an area of about .023 acres and would therefore be required to operate at the rate of about 2,200,000 gallons per acre per day when serving the estimated future population of 500 persons. This rate is excessive for a filter having an average depth of less than 5 feet, and I am of the opinion that the population tributary to the filter should be limited to 350 persons and that whenever this population is exceeded the filter bed area should be increased.

The distributing system of the filter is to consist of an 8-inch cast-iron main, from which are to extend smaller laterals spaced 9½ feet apart. The end of each lateral is to be provided with a 3-inch riser pipe to the top of which is to be attached a square spray nozzle of the Taylor type. The nozzles and risers are spaced 9½ feet longitudinally and 8½ feet transversely. No reason is given for spacing the nozzles as shown but it would seem that the more uniform distribution of the sewage over the surface of the filter would be obtained by having the nozzles spaced the same both ways.

The underdrain system is to consist of a false floor and a central collecting drain located along the longitudinal center line of the filter. The floor of the filter has a slope of 5 per cent. toward the central drain and this drain in turn has a slope of 1 per cent. towards the outlet of the filter. The effluent is to be discharged directly into Ellicott creek through an 8-inch vitrified pipe provided with a gate valve and a flat valve near the outlet. Although the outlet pipe is not shown on the general plans, it appears from the detailed plans of the filter that the elevation of the outlet end of the pipe is 769.2. This is 5.2 feet above the water elevation of the stream shown by the plans. The high water mark of the stream is not shown. The surface of the filter is at elevation 774.5 feet or 10.5 feet above the elevation of the creek shown by the plans and the elevation of the flow line of the settling tank is 18½ feet above the creek level. No data are submitted as to the high water stages of this creek at this point but it would appear that the operation of the plant should not be interfered with except during the extreme high water conditions. It is important, however, that the elevation of the maximum high water of the stream should be furnished.

From our careful examination of the plans it is found that the new sewage disposal plant has in general been designed to meet the local requirement for sewerage and sewage disposal. There are, however, certain additional data which should be submitted and certain modifications or changes made in the plans before they will be in final condition for acceptance.

I would therefore recommend that the plans be returned for changes, additions or modifications in accordance with the following requirements:

1. That a more definite statement as to the future population to be cared for be submitted.

2. That the elevation of the high water mark of Ellicott creek be shown.

3. That the slope of the proposed 6-inch sewer from the detention house to the disposal plant be increased to not less than .6 per cent., or that the size of this sewer be increased to 8 inches in diameter.

4. That the spacing of the bars of the proposed bar screen of the screen of the screen chamber be shown.

5. That scum boards near the inlet and outlet of the settling tank be provided.

6. That the slopes of the partitions forming the bottom of the settling chamber be made not less than 1.2 vertical to 1 horizontal.

7. That the size of the sludge pipe be increased to not less than 6 inches.

8. That the sludge pipe be extended in a straight line from the bottom of the sludge compartment to the surface of the ground in order to permit of cleaning and inspection.

9. That the outlet pipe from the sprinkling filter to the creek be shown by the plans.

Respectfully submitted,

THEODORE HORTON,
Chief Engineer

ALBANY, N. Y., *March* 4, 1915

The plans were returned to the County Engineer for revision on March 5, 1915, in accordance with the above recommendation.

HERMANN M. BIGGS, M.D., *State Commissioner of Health:*

Amended plans for sewage disposal at the Erie County Farm were submitted to this Department for approval on March 23, 1915.

These plans were first submitted for approval on February 3, 1915, and were given careful examination by the Engineering Division. A report setting forth the results of the examination of the plans and making recommendation for certain modifications before their final acceptance was prepared and submitted to you under date of March 4, 1915. The plans were accordingly returned to the County Engineer with the recommendation that additional data be furnished and that the plans be modified in accordance with the following requirements:

1. That a more definite statement as to the future population to be cared for be submitted.

2. That the elevation of the high water mark of Ellicott creek be shown.

3. That the slope of the proposed 6-inch sewer from the detention house to the disposal plant be increased to not less than .6 per cent. or that the size of this sewer be increased to 8 inches in diameter.

4. That the spacing of the bars of the proposed bar screen of the screen chamber be shown.

5. That scum boards near the inlet and outlet of the settling tank be provided.

6. That the slopes of the partitions forming the bottom of the settling chamber be made not less than 1.2 vertical to 1 horizontal.

7. That the size of the sludge pipe be increased to not less than 6 inches.

8. That the sludge pipe be extended in a straight line from the bottom of the sludge compartment to the surface of the ground in order to permit of cleaning and inspection.

9. That the outlet pipe from the sprinkling filter to the creek be shown by the plans.

Our examination of the plans now submitted show that they have been revised in general accordance with all of the above requirements. With respect to a more definite statement asked for as to the future population to be cared for by the plant the County Engineer states that it is impossible to give more accurate information on this point inasmuch as the number of inmates at the farm will depend largely on resolutions of the Board of Supervisors of the county but he believes that 500 is a very liberal estimate. The engineer also states that the highway passing between the disposal plant and the detention house is to be so relocated as to pass east of the house so that the new road will be not less than 600 feet from the disposal plant. If it is found upon operation of the plant that objectionable odors are created by the sprinkling filter this structure, which is comparatively small, could be covered.

The elevation of the high water mark of Ellicott creek is now shown as 771 which is only about 1 foot higher than the bottom of the sprinkling filters. It appears therefore that the operation of the disposal plant will not be materially affected by reason of high water in the creek.

The slope of the proposed sewer from the detention house to the disposal plant has been increased in size to 8 inches in diameter and is to be constructed with a slope of .4 per cent. The details of the screen in the screening chamber show that this screen is to be constructed of 1½-inch x 5/16 inch bars placed 1 inch apart in the clear.

Scum boards have been provided by the plans near the inlet and outlet ends of the tank and the slopes of the partitions between the settling and sludge compartments have been increased to not less than 1.2 vertical to 1 horizontal as required. Changing the slope of these partitions has resulted in reducing the detention period in the settling compartment from 4½ hours to 4 hours when serving the estimated future population of 500. This reduction of capacity, however, should not decrease the efficiency of the tank.

The size of the sludge pipe has been increased to 6 inches and it is shown extending in a straight line from the bottom of the sludge compartment to the surface of the ground so as to facilitate cleaning and inspection. The outlet pipe from the sprinkling filter to the crook is also shown. It appears that it is proposed to discharge the effluent above the low water mark of the stream. If any objectionable odors are created by not having the effluent pipe submerged these conditions can readily be overcome by carrying the pipe out into the stream where it will be submerged at low water and it may be found necessary to so extend the pipe after the plant is put in operation.

In conclusion I would state that it is found from our examination of the plans that they have been revised in general accordance with the requirements of this Department and that the plant if properly constructed and operated should produce an effluent that may be discharged into the stream without objection at this time. I would therefore recommend that the plans be approved and that a permit be issued allowing the discharge into Ellicott creek in the town of Alden of effluent from the proposed sewage disposal plant. I would further recommend that the permit contain in addition to the usual revocation and modification clauses the following conditions:

1. That the effluent pipe be extended to the creek and submerged at low water if upon operation it is found that any objectionable conditions are created by the discharge of effluent upon the bank of the stream.

2. That the population tributary to the sprinkling filter shall be limited to 350 persons unless the capacity of this filter shall be increased in accordance with plans satisfactory to this Department.

Respectfully submitted,

THEODORE HORTON,
Chief Engineer

ALBANY, N. Y., *March* 27, 1915

PERMIT

Application having been duly made to the State Commissioner of Health, as provided by section 76 of chapter 49 of the Laws of 1909, the "Public Health Law, as amended by chapter 553 of the Laws of 1911, constituting chapter 45 of the Consolidated Laws, permission is hereby given to the board of supervisors of Erie county to discharge effluent from the proposed sewage disposal plant of the Erie County Farm into the waters of Ellicott creek at that point of discharge shown by the plans within the town of Alden in accordance with the plans accompanying the petition, under the following conditions:

1. That this permit shall be revocable at any time or subject to modification or change when in the judgment of the State Commissioner of Health such revocation, modification or change shall become necessary.

2. That the issuance of this permit shall not be deemed to affect in any way action by this Department on any future application that may be made for permission to discharge additional sewage or effluent into the waters of this State.

3. That both the sewer system and the sewage disposal works shown by plans approved this day shall be fully constructed in complete conformity with such plans or approved amendments thereof.

4. That only sanitary or domestic sewage, and no storm water or surface water from roads, grounds, roofs or other areas shall be admitted to the proposed sewers.

5. That no sewage sludge from any part of the disposal works shall be discharged into Ellicott creek or any other watercourse.

6. That the effluent pipe from the works shall be extended into the main channel of the creek in such a manner as to be submerged at low water stage if upon operation of the works it is found that objectionable conditions are created by the discharge of effluent at the bank of the stream.

7. That the population to contribute sewage to the sprinkling filter shall be limited to 350 persons unless the capacity of this filter shall be increased in accordance with plans satisfactory to this Department.

LINSLY R. WILLIAMS,
Deputy State Commissioner of Health

March 29, 1915

ALTAMONT (Y. W. C. A. Camp)

HERMANN M. BIGGS, M.D., *State Commissioner of Health:*

Plans for sewerage and sewage disposal for the Y. W. C. A. camp located near Altamont in the town of Knox, were submitted to this Department for approval on September 30, 1915.

An investigation of the disposal of sewage from this camp was made by a representative of this Department on July 6, 1915. It is found from this inspection that the present method of disposing of the sewage from the different buildings at the camp was inadequate and that insanitary conditions resulted in the stream below the camp by the discharge of improperly treated sewage into it. This stream, which is dry during portions of the summer, flows through farm lands and through the village of Altamont. It was recommended to the Y. W. C. A. that steps be taken by the camp authorities to provide for proper and adequate means of sewage disposal.

The plans now presented were submitted in compliance with the recommendations of this Department. They were prepared by Mr. Henry W. Taylor, Consulting Engineer, Albany, N. Y., and comprise three sheets of blue prints showing general layout and details of the sewerage and sewage disposal systems. The plans were accompanied by an engineering report.

This report states that the population during the month of June at the camp averages about 140; in July about 210; and in August 250, giving an average population for the three months of 200. The maximum water consumption taken from tank measurements on the water supply system is given at 6,000 gallons per day, equal to about 30 gallons per capita. The report also states that the camp has practically reached its capacity and that rather than enlarge this particular camp another camp at a different locality would be instituted.

The plans presented show that it is proposed to collect the sewage from the five buildings comprising the camp by means of a system of six-inch sewers. These sewers are all to be constructed with fairly steep slopes, the minimum slope being 6 per cent. Manholes are to be installed at all points of change of slope and alignment.

It is proposed to treat the sewage collected by this system in a sewage disposal plant consisting of an Imhoff tank, dosing chamber, sprinkling filter, dosing tank, three intermittent sand filters followed by an absorption trench about 2,000 feet long.

The settling tank is circular in plan, has a diameter of 9 feet and a depth of about 9 feet. It is divided by means of slate partitions into an upper or settling compartment and a lower or sludge storage compartment. The settling compartment has a capacity of about 1,600 gallons, equal to an average flow of about 6½ hours. The sludge compartment has a capacity of some 150 cubic feet. Although the settling tank is to be provided with a six-inch sludge pipe controlled by a six-inch valve, no sludge drying bed is provided and it appears from a note on the plans that it is proposed to discharge the sludge on top of the ground. This practice would be likely to cause the sludge to flow into the stream and give rise to insanitary conditions. It would be better to have the sludge discharge into a sludge drying bed or into trenches and covered over.

From the settling tank the effluent is to flow over a weir into an adjacent dosing tank having a capacity of about 130 gallons. This tank is to be provided with an intermittent discharge siphon, by means of which the sewage is to be discharged into the distributing system of the sprinkling filter located about 40 feet from the settling tank.

This filter has an area of about .007 acre and is to be filled to a depth of 5.5 feet with filtering material composed of stones varying from 2½ to 1 inch in size. The larger size stones are to be placed on the bottom of the filter and stones from 1 to 1½ inches in size are to be placed in the upper half of the filter. The distributing system is to consist of 3-inch wrought iron main and two 3-inch laterals at the ends of which are to be placed circular spray nozzles.

On the basis of the actual flow of sewage the rate of operation of the filter will be about 850,000 gallons per day. On the basis of population, assuming a per capita rate of water consumption of 100 gallons per day the rate of operation would vary from 2,000,000 to 3,500,000 gallons per day. Although this rate would be rather high for filters of this type operating the year around, it is probable that no difficulty will be experienced from clogging during the three months which they will be required to operate.

The effluent from the sprinkling filter is to be discharged into a combined settling and dosing tank having a capacity of 1,100 gallons. At the lower end of this tank are to be placed two alternate siphons which will draw down the sewage 13 inches in the combined settling and dosing tank at each discharge of the siphon. These siphons are planned to discharge alternately to two of the three intermittent sand filters, thus leaving one filter in reserve.

These filters, which are to vary in depth from 2.5 to 2¾ feet, have a combined superficial area of .033 acres. The rate of operation provided for will, therefore, be about 180,000 gallons per acre per day on the basis of actual water consumption. On the usual assumption as to sewage contribution the rate of operation will vary from about 420,000 to 760,000 gallons per acre per day.

Although this rate would be excessive for continuous operating it is probable that no serious difficulty will be experienced in operating the filters for a period of about three months during the summer at a maximum rate of say 500,000 gallons per acre per day. The filters will, however, require constant attention in order to prevent them from clogging. This appears to have been realized by the designing engineer, who stated that the plant will have adequate maintenance and that it will be more economical for the camp to increase the maintenance charges than to increase the cost of installation, which will be high owing to the high cost of sand delivered at the site. If serious difficulty is experienced in operating the plant, it appears that the location is such as to permit of installing additional units.

As noted above, the effluent from the plant is to be discharged into an absorption trench which is about 2,000 feet long and it is probable that a large portion of the effluent will be absorbed by the soil before it reaches the stream except during wet weather conditions.

In conclusion I would state that it appears from our careful examination of the plans that although the sprinkling filters are rather limited in area, the plant has been designed to satisfactorily meet the local requirements for sewage disposal.

I would, therefore, recommend that the plans be approved and a permit be issued allowing the discharge effluent from the proposed sewage disposal plant into a tributary of Black creek within the town of Knox on the following conditions:

1. That means for the disposal of the sludge either on a properly constructed sludge drying bed or in trenches be provided.
2. That the sand filters when constructed be enlarged to provide for a rate of operation not to exceed 500,000 gallons per acre per day.
3. That whenever required the sprinkling filter and sand filters shall be enlarged.

Respectfully submitted,

THEODORE HORTON,
Chief Engineer

ALBANY, N. Y., *October* 5, 1915

PERMIT

Application having been duly made to the State Commissioner of Health, as provided by section 76 of chapter 49 of the Laws of 1909, the "Public Health Law," as amended by chapter 553 of the Laws of 1911, constituting chapter 45 of the Consolidated Laws, permission is hereby given to the board of managers of the Y. W. C. A. camp, town of Knox, Albany county, to discharge effluent from the sewage disposal works to be constructed at the camp into the waters of a tributary of Black creek at the point of discharge shown by plans within the town of Knox in accordance with the plans accompanying the petition, under the following conditions:

1. That this permit shall be revocable at any time or subject to modification or change when in the judgment of the State Commissioner of Health such revocation, modification or change shall become necessary.
2. That the issuance of this permit shall not be deemed to affect in any way action by this Department on any future application that may be made for permission to discharge additional sewage or effluent into the waters of this State.
3. That both the sewers and the sewage disposal works shown by plans approved this day shall be constructed in complete conformity with such plans or approved amendments thereof except that the sand filters when constructed shall provide for a maximum rate of operation not to exceed 500,000 gallons per acre per day on the basis of 100 gallons per person contributing sewage to the plant.
4. That only sanitary or domestic sewage and no storm water or surface water from grounds, roofs, or other areas shall be admitted to the sewage disposal works.
5. That no sewage sludge from any part of the disposal works shall be discharged into the tributary of Black creek or into any other watercourse or body of water.
6. That means for the disposal of sludge either on a properly constructed sludge drying bed or in trenches shall be provided.
7. That whenever required by the State Commissioner of Health either the sprinkling filter or the sand filters or both shall be enlarged in accordance with plans satisfactory to this Department.

LINSLY R. WILLIAMS,
Deputy State Commissioner of Health

October 13, 1915

AMENIA (High School)

HERMANN M. BIGGS, M.D., *State Commissioner of Health:*

Plans for sewage disposal at the Amenia High School at Amenia, Dutchess county, were submitted to this Department for approval on September 9, 1915.

These plans were first submitted for approval in person by the designing engineer on August 30, 1915, but as they were not in satisfactory condition for approval the engineer was advised to complete the plans and to add dimensions and capacities of the different portions of the sewage disposal system. It was learned from him that the soil at the school property was a coarse yellow sand and that the ground sloped toward an intermittent stream some distance from the rear of the building.

The plans now presented provide for a sewage disposal plant consisting of a cesspool and subsurface irrigation system. The plans show the general location of the different portions of the sewage disposal plant with reference to the school building and the school property but do not show details of the different structures. Notes on the plans state that the school will accommodate about 125 pupils and that the cesspool, which is to be located about 25 feet from the rear of the building, is to have a capacity of from 5 to 10 cubic feet per person served.

The subsurface irrigation system is to consist of five lines of main distributing tile radiating from the cesspool and the number of short lateral lines extending from each of the main distributors. A note on the plans indicates that the distributing system is to contain 10 feet of tile per pupil served, which would be equal to about 1,250 feet of tiling. There appears to be sufficient area available on the school property to permit of extending the system should it be found necessary to do so in the future.

The slope of the sewer leading from the schoolhouse to the cesspool is not shown. It should be constructed of pipe not less than 6 inches in diameter and should be laid with a slope of not less than 1 per cent. The cesspool should be covered and have a capacity of not less than 5 cubic feet per person served. The cover over the cesspool should be so arranged as to permit of cleaning and inspection.

The outlet end of each of the distributing tiles leading from the cesspool should be provided with a quarter bend, thus forming submerged outlets in order to prevent scum, which accumulates in cesspools of this type, from floating out into the distributing tiles and clogging the subsurface irrigation system.

The tile composing the system should be not less than 3 inches in diameter and should be laid with slope of about 1/8 of an inch per foot and at a depth of about 18 inches below the surface of the ground. The tiling should be laid with open joints and these joints should be surrounded with coarse material and covered with strips of tar paper in order to prevent the infiltration of sand into the tile and the consequent clogging of the system.

In conclusion I would state that it appears from our examination of plans that the proposed sewage disposal plant if properly constructed in accordance with the plans and the recommendations embodied in this report should satisfactorily care for the sanitary sewage of the school.

In view of the above I would recommend that the plans be approved. The school authorities should be advised that no storm or surface water from roofs or other areas should be admitted to the disposal plant.

Respectfully submitted,

THEODORE HORTON,
Chief Engineer

ALBANY, N. Y., *September* 15, 1915

The plans were approved on September 17, 1915, on the condition that the recommendations contained in the above report be followed in the construction of the sewage disposal plant.

AUBURN

Hermann M. Biggs, M.D., *State Commissioner of Health:*

Plans for proposed sanitary sewer extensions in the city of Auburn, Cayuga County, were submitted for approval by the City Engineer on behalf of the Common Council on April 29, 1915.

The plans provide for comparatively short sewer extensions in Thornton avenue, Cash avenue, Carpenter street, Park avenue, West, and along the New York Central railroad right of way. The proposed sewer in Thornton avenue which is to be 8 inches in diameter with a slope of .6 per cent is to extend from Center street to Joseph street, a distance of 685 feet. It is to discharge into the existing sewer in Thornton avenue which is tributary to the existing outlet sewer which discharges into the Owasco outlet near Canoga street in the western part of the city. The plans also provide for lowering some 210 feet of the upper portion of the existing sewer in Thornton avenue. According to the report of the city engineer, the proposed sewer is at present to care for one new dwelling.

The Cash avenue sewer is to extend from a point between Lake and Gold avenues to Osborne street, a distance of 1100 feet. This sewer is to be 8 inches in diameter and is to be constructed with slopes of from 1.4 per cent. to 4.2 per cent. It is to serve three houses at present and is to be tributary to the existing sewer which empties into the Owasco outlet below the lower pumping station.

The proposed sewers in Carpenter street and Park avenue West, are to be 8 inches in diameter and are to be tributary to the proposed 10-inch sewers to be constructed along the New York Central right of way. These sewers are all to be tributary to the Fifth Ward trunk sewer which discharges into the Owasco outlet near the State street bridge.

According to the city engineer's report the territory drained by the proposed sewers in Carpenter street and Park avenue West, was originally included in the 4th, 5th, 6th and 7th Wards Sewer District, tributary to one of the existing sewage disposal works of the city, but it was found impracticable to connect with the sewers in this district owing to the location of the New York Central tracks and the plant of the International Harvester Company.

It would appear from the report of the city engineer and the communication received from the city clerk, that there is urgent need for sewerage facilities in the section to be served by the proposed sewers.

It is found from our examination of plans that the design of the proposed sewers is satisfactory as far as size, slopes, capacities and facilities for cleaning and inspection are concerned, and if the sewers are properly constructed they should meet the probable future needs for sewerage in the section to be served by them. Owing to the condition of pollution of the Owasco outlet, steps should be taken to provide for the treatment of the sewage of the city now discharging into this stream without treatment. The city authorities were advised under date of September 10, 1914, when plans for proposed sewers in Arlington avenue, Kensington avenue and other streets were approved that in all probability "no further approval of plans for sewer extention in the city, except perhaps in special instances, will be given by this Department until plans for the interception and treatment of the sewage of the city have been prepared and submitted to this Department for approval."

It may be stated, however, that the construction of the proposed sewers which are comparatively short will not materially increase the pollution of the Owasco outlet in the immediate future and in view of the above and of the apparently urgent needs for sewers in the sections of the city to be served by them, I am of the opinion that the plans for the proposed sewers might consistently be approved.

I would recommend, therefore, that the plans be approved and the permit be issued allowing the discharge of sewage from the proposed sewers into the Owasco outlet through existing outfall sewers. I would further recommend that the permit contain in addition to the usual revocation and modification

clauses the same conditions with reference to the interception and treatment of the sanitary sewage of the city as contained in the permits previously issued.

Respectfully submitted,
THEODORE HORTON,
Chief Engineer

Albany, N. Y., *May* 7, 1915

Permit

Application having been duly made to the State Commissioner of Health, as provided by section 77 of chapter 49 of the Laws of 1909, the "Public Health Law," as amended by chapter 553 of the Laws of 1911, constituting chapter 45 of the Consolidated Laws, permission is hereby given to the Common Council of the city of Auburn to discharge sewage from the proposed sewers in Thornton avenue and other streets into the waters of Owasco outlet through existing outlet sewers within the municipality of Auburn in accordance with the plans accompanying the petition, under the following conditions:

1. That this permit shall be revocable at any time or subject to modification or change when in the judgment of the State Commissioner of Health such revocation, modification or change shall become necessary.
2. That the issuance of this permit shall not be deemed to affect in any action by this Department on any future application that may be made for permission to discharge additional sewage or effluent into the waters of this State.
3. That only sanitary or domestic sewage, and no storm water or surface water from streets, roofs or other areas shall be admitted to the proposed sewers.
4. That whenever required by the State Commissioner of Health, satisfactory detailed plans for the interception and treatment of the entire sanitary sewage of the city or of any portion of such sewage not treated by the sewage disposal plants now in operation shall be prepared and submitted to this Department for approval; and that within the time limit stated within such requirement, any or all portions of such sewage disposal works shown by said plans as may be specified shall be constructed and put in operation.

LINSLY R. WILLIAMS,
Deputy State Commissioner of Health

May 11, 1915

AURORA (Wells College)

Plans for sewage disposal for Wells College at Aurora were approved on September 24, 1915, and the following permit issued:

Permit

Application having been duly made to the State Commissioner of Health, as provided by section 76 of chapter 49 of the Laws of 1909, the "Public Health Law," as amended by chapter 553 of the Laws of 1911, constituting chapter 45 of the Consolidated Laws, permission is hereby given to Wells College at Aurora to discharge effluent from the two proposed sewage disposal plants at the college into the waters of Cayuga Lake near the boat house pier within the municipality of Aurora in accordance with the plans and engineering report accompanying the petition, under the following conditions:

1. That this permit shall be revocable at any time or subject to modification or change when in the judgment of the State Commissioner of Health such revocation, modification or change shall become necessary.

2. That the issuance of this permit shall not be deemed to affect in any way action by this Department on any future application that may be made for permission to discharge additional sewage or effluent into the waters of this State.

3. That the sewage disposal works shown by plans approved this day shall be fully constructed in complete conformity with such plans or approved amendments thereof.

4. That only sanitary or domestic sewage and no storm water or surface water from streets, roofs or other areas shall be admitted to the proposed sewers.

5. That no sewage sludge from any part of the disposal works shall be discharged into Cayuga Lake or any other watercourse.

6. That not less than five parts of available chlorine per million parts of sewage treated shall be applied uniformly to the effluent from the settling tanks before its discharge into Cayuga Lake and that this proportion shall be increased when required by the State Commissioner of Health.

7. That whenever required by the State Commissioner of Health, satisfactory plans for additional works for more complete treatment of the sewage of Wells College shall be submitted for approval; and upon approval of said plans any or all portions of such additional or supplementary works for more complete treatment of sewage shall be constructed and put in operation at such time or times thereafter as said commissioner may designate.

LINSLY R. WILLIAMS,
Deputy State Commissioner of Health

September 24, 1915

BABYLON (Union School)

HERMANN M. BIGGS, M.D., *State Commissioner of Health:*

Plans for sewage disposal for the Union Free School District No. 1 in the town of Babylon, located in the village of Babylon, Suffolk county, were submitted for approval on September 13, 1915.

The plans were first submitted for approval on August 2, 1915, but it was found from our preliminary examination of them that they were not in satisfactory condition for approval and that they did not contain sufficient data to finally pass upon them and they were therefore, returned for modifications and additional data on August 12, 1915.

The plans now submitted show that they have been revised in general accordance with the recommendations of this Department. According to the report submitted with the plans the average population at the school to be served by the disposal plant will be 275 and the soil at the disposal site consists of mixed sand and gravel which it is stated absorbs water very rapidly.

The plans show, that it is proposed to collect the sewage from the toilet rooms of the school building and convey it to the disposal plant through two lines of sewers each 150 feet long. These lines join at a point near the disposal plant. The sewers are to consist of 6-inch tile pipe laid with slopes of ¼-inch per foot.

It is proposed to treat the sewage collected by these sewers in a sewage disposal plant consisting of a settling tank, two cesspool tanks and a subsurface irrigation system divided into two sections. Although the details of the design are not shown it appears from the notes on the plans that the settling tank and the cesspools are to be 6 feet deep and 9 feet in diameter. They are to be connected by means of 6-inch tile pipe and are to be provided with submerged inlets and outlets. The tank and cesspools will have a capacity of about 2,800 gallons each which is equal to about one day's flow of sewage assuming a per capita rate of sewage contribution is 10 gallons per day, the tank through which the sewage is to pass first is to be

made water tight and the walls of the cesspools are to be laid with loose joints.

According to the specifications the inlet to the settling tank is to terminate at a point about 18 inches from the bottom. It would be better to have the inlet pipe which is to be provided with a "T" fitting terminate from 3 to 4 feet from the bottom in order to prevent the stirring up of sludge in the tank by the discharge of sewage into it. The covers over the tank and cesspools should also be so made as to be removable and permit of cleaning and inspecting the structures. The tanks should be cleaned out at least once a year and the sludge disposed of in covered trenches located at a considerable distance from any well or watercourse.

The effluent from the last cesspool is to be discharged through a 6-inch pipe to a diverting manhole by means of which it may be discharged into either of the two proposed subsurface irrigation fields. The distributing system of the subsurface irrigation field is to contain 1500 feet of 6-inch horseshoe tile and will cover an area of about 1/7 of an acre. It appears therefore, that about 5½ feet of tiling per person served is to be provided and that the rate of operation of the system will be about 20,000 gallons per acre per day assuming that none of the sewage leaches away into the soil at the two leaching cesspools which, of course, is not the case. The net rate will in all probability, be considerably less and should not be excessive for a soil of this nature.

According to a note on the plans the lines of tile are to be placed 4 feet center to center and laid on a slope of ¼ of an inch to the foot at a depth of 3 feet below the surface of the ground. The tiles are to be laid with open joints which are to be covered with tar paper.

The size and kind of tile to be used in the main distributor from which the lateral distributors extend are not shown. These main distributors should be laid with tight joints and should be provided with "Y" and "T" fittings at each lateral line. It would be better also if the lateral tiles were laid not more than 24 inches and preferably not more than 18 inches below the surface of the ground if the topography at the site of the disposal plant is such as to permit of doing so. Care should also be taken to carefully protect the joints in order to prevent the infiltration of sand into the pipes and the consequent clogging of the system. It would be well to cover the latter distributors with gravel after covering the individual joints with tar paper.

From our careful examination of plans it would appear that the proposed sewage disposal plant if properly constructed in accordance with the plans and suggestions embodied in this report should satisfactorily care for the sewage from the school on the basis of design used. If it should be found on operation that the subsurface irrigation system is not large enough to properly care for the sewage, it appears that there is sufficient area available for extending the system should it be necessary to do so.

I would, therefore, recommend that the plans be approved on the following conditions:

1. That the covers over the tank and cesspools be made removable so as to permit of cleaning and inspecting them.
2. That the submerged inlets and outlets of the tank and cesspools shall not extend nearer than 3 feet from the bottom of these structures.
3. That the main distributing lines of the subsurface irrigation fields shall be constructed of tile pipe laid with tight joints and provided with "Y" or "T" fittings at the point where each lateral distributor leaves the main distributor.
4. That the lateral distributors be laid at depths not more than from 18 to 24 inches below the surface of the ground if possible.

Respectfully submitted,

THEODORE HORTON,
Chief Engineer

ALBANY, N. Y., *September* 24, 1915

The plans were approved on September 27, 1915, on the condition that the above recommendations be followed in the construction of the sewage disposal plant.

BEDFORD (New York State Reformatory for Women)

HERMANN M. BIGGS, M.D., *State Commissioner of Health*:

Revised plans for sewage disposal for the New York State Reformatory for Women at Bedford Hills, Westchester county, were submitted to this Department for approval by the State Architect under and in accordance with the provisions of section 14 of the Public Health Law.

Plans for a new sewage disposal plant for this institution consisting of an electrolytic plant, sand filters and a hypochlorite treatment plant were approved on May 14, 1914 on the following conditions:

> 1. That the installation and subsequent operation of the plant shall be at all times satisfactory to this Department.
>
> 2. That regular reports of the operation of the plant shall be submitted to this Department in such form and at such times as it may require.
>
> 3. That if at any time the operation of the electrolytic plant shall not prove satisfactory to this Department, it shall be abandoned, and the other portions of the plant at once modified and operated in accordance with the directions of this Department.
>
> 4. That the complete works shown by the plans including the sand filters and chlorination plant be constructed and the sand filter beds and chlorination plant shall be so maintained as to permit of putting them in operation at any time when required by this Department.
>
> 5. That at all times the sand filter bed shall have an area not less than a ratio of one acre to 600 population and that when the sand filters are in operation the effluent shall be disinfected by chlorination, using not less than five parts of available chlorine per million parts of sewage effluent and that the preliminary tank capacity shall be increased proportionately.

On December 17, 1914, amended plans providing for rearranging of the building of the electrolytic plant in order to accommodate electrolizers of the horizontal type rather than the vertical type provided for by the plans approved on May 14 were approved.

The plans now presented and under consideration show that it is proposed to omit the electrolytic plant, to convert the three settling tanks, which were to have been operated as preliminary and final settling tanks in connection with the electrolizers, into Imhoff tanks and to substitute liquid chlorine apparatus of the Wallace and Tiernan type for the hypochlorite plant provided for by the plans referred to above. The proposed sewage disposal plant which has been modified in general accordance with our suggestions, will, therefore, consist of three settling tanks of the Imhoff type, eight sand filters having a combined area of one acre according to scaled dimensions, liquid chlorine apparatus by means of which liquid chlorine is to be applied to the effluent from the sand filters and a sludge drying bed to care for the sludge from the settling tanks.

The proposed Imhoff tanks which are to be 20 feet in diameter and 24 feet deep are to be of the horizontal flow type and are so arranged that the different tanks may be operated either in series or in parallel. Each tank is to be divided by means of concrete partitions into an upper settling compartment and a lower hopper shaped sludge compartment. The combined settling capacity of the three tanks according to scaled dimensions is sufficient to give a time of detention of about 7½ hours when serving 600 persons assuming an average daily rate of sewage contribution of 150 gallons per person, which it is understood, is the present rate of water consumption at the institution. The combined capacity of the sludge compartments is about 2400 gallons. It appears therefore that the settling tanks are of adequate capacity to meet the present needs of the institution and to allow for a reasonable increase in the population in the future.

A 6-inch sludge pipe is shown by the general plans connecting each of the settling tanks with the proposed sludge drying bed. This pipe is not shown on the cross section of one of the tanks but it is assumed that it will extend to a point near the bottom of the settling tanks and that it will be so arranged that the sludge may be discharged by gravity flow to the sludge bed. These details should, however, be shown on the plan.

There are no baffles shown on any of the tanks. Each tank should be provided with a baffle near the inlet and one baffle near the outlet. These bafflles should extend from about 12 inches above to about 12 inches below the flow line of each tank.

The proposed sludge bed, which is shown in detail, is to be located adjacent to the settling tank near filter No. 4 and is to have an area of 400 square feet. It is to be filled to an average depth of 14 inches with graded gravel and is to have a top layer of mortar sand ¼-inch deep. The underdrain from the sludge bed is shown discharging to filter No. 8.

The surface elevation of the sludge bed is 273.0 and this is the only elevation shown by the plans. Assuming that the elevations of the sand filters are to be the same as shown by the approved plans it would not be possible to discharge the effluent from the sludge bed to the surface of filter No. 8 inasmuch as the surface in this filter which is shown as having an elevation of 272.0 is about 6 inches higher than the bottom of the sludge bed. It might be possible, however, to extend the sludge drain to bed No. 6 which is shown on the original plans with a surface elevation of 270.5 or about one foot lower than the bottom of the sludge bed.

Sand filters although not shown in detail are presumably to be constructed in accordance with the approved plan. The combined area of filters is one acre and they will therefore provide for a rate of operation of 60,000 gallons per acre per day when serving a population of 600 persons on the basis of a per capita flow of sewage of 100 gallons per day.

The sewage is apparently to be applied to the beds continuously there being no dosing apparatus provided. Although, owing to the number of beds and their arrangement it would be possible to throw one or more beds out of use for a day or a week at a time as may be desired and thereby obtaining a certain intermittency of operation it will not be practicable to operate the beds intermittently during the day, except under constant attendance which would not be effective, unless under intelligent supervision, without the use of dosing devices. It is essential considering the nature of the stream into which effluent is to be discharged that the proposed plant shall be operated with the highest possible efficiency and such results could probably not be obtained without the use of proper dosing devices. The installation of dosing devices will require lowering filters Nos. 3 and 4 in order to obtain sufficient head to operate the siphons.

The plans provide for a disinfection of the effluent from the sand filters and show a chlorination plant provided with liquid chlorine machines of the Wallace and Tiernan type to be located in a small building along the line of the effluent pipe from the sand filters between the filters and Broad brook. The effluent pipe from the filters is to be divided into two branches immediately above the chlorination plant and these branches which are to continue through the plant are shown uniting below the plant. A diffusion chamber about 12 inches square and 8 feet deep is to be constructed on each of the branches. These chambers and pipes from the chlorine apparatus are so arranged that the chlorine may be applied at either or both chambers.

From these chambers it is planned to discharge the treated effluent directly into Broad brook through a short line of sewer. No detention or reaction chamber is provided below the point of application of the chlorine. A small chamber giving a detention period of at least 15 minutes should be installed below the point of application of liquid chlorine to the effluent from the filters. It would be well to have this chamber provided with baffles.

From our careful examination of the plans it is found that although they have generally been designed in accordance with the suggestions of this Department they are lacking in details, dimensions and elevations and that there are certain other modifications and additions as follows which

of the sludge compartment and the other near the junction of the vertical sides and the sloping bottoms of each of the settling tanks. This water pipe is to be 1½ inches in diameter and the perforations are to consist of 3/16 inch holes spaced 18 inches center to center. It is also planned to construct a disinfection chamber giving a detention period of about 23 minutes immediately below the diffusion chamber of the chlorination plant.

The proposed dosing device consisting of a dosing tank 10 feet by 30 feet by 1½ feet deep provided with a 4-inch discharge siphon of the Miller type is not satisfactory. The tank if constructed as proposed would act as a settling basin and would in all probability, silt up rapidly and it would be difficult to clean the tank, inasmuch as it is covered and has only one manhole which is located near the outlet. The siphon moreover, is not large enough to care for a maximum flow of sewage and provide for the proper distribution of the sewage over the surface of the filter.

Although the specifications stipulate that: "The inverts of the outlet pipes from the tank shall be raised 12 inches from their normal position at the bottom of the outlet trough to provide sufficient head for the dosing tank" and that "in order to obtain sufficient fall or grade for the operation of the siphon and dosing tank, it will be necessary to lower all the elevations on filter beds Nos. 3 and 4," these modifications are not shown on the plans nor are any elevations of the filters given, it is, therefore, impossible to finally pass on the plans or to make definite recommendations with reference to them.

As sufficient head can apparently be obtained by modifying the plans as stated in the specifications to operate alternate siphons such siphons should be installed. Owing to the number and comparatively large sizes of the beds to be dosed, two dosing tanks containing four 8-inch alternating siphons should be installed. These tanks should be located either where the distributing manholes are now shown in the central portion of each group of filters or at the manholes on the effluent pipe leading from the settling tanks to the filters and the pipes connected with the dosing tanks should be provided with valves and so arranged as to permit of discharging effluent into either of the two dosing tanks. The dosing tank should be large enough to flood one of the filter beds to a depth of not less than one inch. Although it appears that siphons not less than 8 inches in diameter should be installed it will, of course, be necessary for the State Architect or the contractor to obtain from the siphon manufacturer, the minimum heads under which plural alternating siphons of this size may be operated.

I would, therefore, recommend that the plans be returned for revision in the following respects:

1. That continuous profile or profiles through the disposal plant from the inlet to the outlet showing elevations of different portions of all parts of the disposal plant be shown; or that equivalent elevations and data be shown upon the present plans.
2. That two dosing tanks provided with four 8-inch alternating siphons each be provided.
3. That each dosing tank be large enough to flood one of the filters to a depth of not less than one inch at each discharge of the siphon and that the piping connecting the settling tanks with the dosing tanks be so arranged as to permit of operating either dosing tank at one time.
4. That the by-pass leading from the settling tank effluent pipe to the chlorination plant between filters Nos. 2 and 3, and 5 and 7 be omitted.

Respectfully submitted,

THEODORE HORTON,
Chief Engineer

ALBANY, N. Y., *June* 1, 1915

The plans were returned for revision on June 3, 1915, in accordance with the above recommendation.

HERMANN M. BIGGS, M.D., *State Commissioner of Health*:

Revised plans for amendments of the plans for sewage disposal for the New York State Reformatory for Women at Bedford Hills, were submitted to this Department for approval on June 26, 1915.

These plans were first submitted for approval on May 5, 1915, but as they were not in satisfactory condition for approval and were therefore returned for revision on May 10, 1915, with the recommendations that the plans be modified in a number of respects as outlined in our report on the examination of the plans dated May 7, 1915. Plans revised in general accordance with our recommendations were resubmitted for approval on May 27, 1915. There were, however, certain features of the design which were not satisfactory and the plans were again returned for revision in the following respects:

1. That continuous profile or profiles through the disposal plant from the inlet to the outlet showing elevations of different portions of all parts of the disposal plant be shown; or that equivalent elevations and data be shown upon the present plans.
2. That two dosing tanks provided with four 8-inch alternating siphons each be provided.
3. That each dosing tank be large enough to flood one of the filters to a depth of not less than one inch at each discharge of the siphon and that the piping connecting the settling tanks with the dosing tanks be so arranged as to permit of operating either dosing tank at one time.
4. That the by-pass leading from the settling tank effluent pipe to the chlorination plant between filters Nos. 2 and 3, and 5 and 7 be omitted.

The plans now submitted and under consideration have been revised in accordance with all of the above requirements and provide for a sewage disposal plant consisting of 3 settling tanks of the Imhoff type, two dosing tanks, eight intermittent sand filters, a liquid chlorine sterilization plant, and an auxiliary sludge drying bed.

Reference is made to the reports on the previous examination of the plans dated May 7 and June 1, 1915, for a description of sewage disposal plant and details of the design and capacities of the different portions of the plant.

The present plans show a continuous profile through the plant from the inlet to the outlet at the brook as required. Although the depth of the filters is not shown the sand according to scale is to be 3 feet deep and is to be supported by a lower layer of gravel which is also to cover and surrround the underdrain.

The plans now show two covered dosing tanks each of which is to be provided with 4 alternating siphons having a drawing depth of 24 inches. The tanks are to be located in the central portion of each of the two groups of 4 filters and each tank is to serve 4 filters. The manholes on the effluent pipe from the settling tanks are to be provided with valves to permit of discharging the effluent into either or both of the two dosing tanks.

Each dosing tank is to be 27 feet by 3 feet by 4 feet 6 inches deep inside dimensions and each discharge of siphon will flood one of the filters to a depth of about one inch. The concrete roofs of the tanks are to be provided with 3 feet 6 inches by 3 feet 6 inches trap doors, one on each side the dosing devices. One or two large trap doors should also be placed over the dosing siphons of each tank in order to make them more accessible for inspection and repair.

The by-pass leading from the settling tank effluent pipe to the chlorination plant shown by the plans first submitted has been omitted as recommended so that there is now no opportunity for by-passing the sand filters.

It is found from the examination of the plans that the proposed sewage disposal plant has been designed along conservative lines and that if properly constructed and if operated with care and efficiency should satisfactorily care for the sanitary sewage of a population of 600 persons and produce an effluent that may be safely discharged into Broad brook without objection. Whenever the population tributary to the plant shall exceed 600 persons the disposal plant and more especially the sand filters should be increased in size or additional filters added. I would, therefore, recommend that the plans be approved on the following conditions:

1. That the installation and subsequent operation of the plant shall be at all times satisfactory to this Department.

2. That regular reports of the operation of the plant shall be submitted to this Department in such form and at such times as it may require.

3. That at all times the sand filters shall have an area of one acre to 600 population and that the effluent from the sand filters shall be disinfected by chlorination, using not less than 5 parts of available chlorine per million parts of sewage and that the preliminary settling tank capacity shall be increased when necessary.

4. That the distributing and underdrain systems of the sand filters shall be constructed in complete conformity to the plans approved on May 14, 1914, except with respect to elevations.

5. That large trap doors or a readily removable cover be placed in the roof over the dosing siphons of each dosing tank.

Respectfully submitted,

THEODORE HORTON,
Chief Engineer

ALBANY, N. Y., *July* 2, 1915

The plans were approved on July 7, 1915, subject to the conditions stated above.

BERGEN (Union School)

HERMANN M. BIGGS, M.D., *State Commissioner of Health*:

Plans for sewage disposal for the Bergen Union School at Bergen, Genesee county, were submitted to this Department for approval on August 31, 1915.

These plans were first submitted for approval on July 28 and provided for the disposal of the sewage from the school in a deep cesspool located near the school building. It was found from our preliminary examination of the plans that the proposed method of disposal would in all probability not care for the sewage of the school satisfactorily and on August 6, 1915, an inspection of the school property was made with a view of advising the school board on the question of sewage disposal. This inspection showed that the soil of the school property was of a sandy loam well suited to subsurface irrigation and that by placing the proposed toilet rooms on the ground floor instead of in the basement as proposed by the original plans, this system could be utilized. Plans providing for the disposal of the sewage from the school by sedimentation and subsurface irrigation were accordingly received on August 31, 1915.

It was learned from the board of education that the school will have an attendance of about 200. Two toilet rooms are to be provided, one for boys and the other for the use of the girls. The two toilet rooms are to be located on the ground floor on opposite sides of the building. Each of the toilet rooms is to be served by a separate disposal plant consisting of a septic tank and subsurface irrigation system divided into two sections. The settling tanks are to be located near the fence line on each side of the building and the subsurface irrigation systems are to be located in front of the school building between the school and street line. The slope of the ground is such that the irrigation systems could not be located at any other place on the school property.

Both of the settling tanks are to be constructed of reinforced concrete and are to be provided with manhole openings and covers. The tanks are to have submerged inlets and outlets consisting of quarter bend pipes extending about 18 inches below the flow line. Each tank is to be 9 feet long, 4 feet wide and 4 feet 6 inches deep inside dimensions, with a depth below the flow line of 3 feet 6 inches. The combined capacity of the two tanks will

give about one day's detention for the sewage on the usual assumptions as to per capita rates of sewage contribution for schoolhouses.

Although no statement was made as to the proposed method of disposing of the sludge, it appears that no difficulty should be experienced from this source as the sludge may readily be removed during the summer months by bailing or pumping and discharged into trenches and covered over. It is important, however, that it should be disposed of at a sufficient distance from any house, stream or body of water to prevent the creation of a local nuisance or the pollution of any watercourse.

From each of the settling tanks the effluent is to flow into an adjacent so-called distributing tank which is to be 4 feet by 3 feet in plan and 18 inches deep. Each of these tanks is to be provided with two submerged outlets which are to discharge into the two portions of the subsurface irrigation system. It should not be necessary to provide for a submerged outlet on the discharge line from the distributing tanks inasmuch as the sewage is discharged into the tanks from the settling tanks through a submerged inlet. It would be better to remove the quarter bend on the outlets from the distributing tanks in order to facilitate the plugging or closing either of the two outlets and thus cutting either of the two sections of the subsurface irrigation system out of use for resting if desired.

The subsurface irrigation systems cover an area of about .3 of an acre and consists of 4 lines of 6-inch main distributors and 18 parallel lines of 3-inch laterals. According to the plans the upper portions of the distributing mains are to consist of hub and spigot tile and the lower portions of field tile.

The entire length of the main distributors should consist of hub and spigot tile and 6″ x 3″ "Y" connection should be provided at each point where a lateral distributor leaves the main distributor in order to obtain satisfactory connections. According to a note on the plans the laterals, which are to be spaced ten feet apart, are to be laid with open joints covered with tar paper at a depth of from 18 to 24 inches below the ground, and are to have a slope of .5 per cent. Each of the two distributing systems will contain about 560 feet of lateral distributors and will therefore provide for about 5.6 feet of distributing tile per person served. The rate of operation of the disposal field will be about 7,000 gallons per acre per day, assuming a per capita rate of sewage contribution of 10 gallons per person.

From our careful examination of the plans it appears that the proposed sewage disposal system if modified slightly should satisfactorily care for the sewage from the school. I would therefore recommend that the plans be approved on condition that the quarter bend fittings on the inlet ends of the outlets from the distributing tanks be omitted and that the entire lengths of the main distributors be constructed of hub and spigot tile pipe with 6″ x 3″ "Y" fittings at each branch distributor.

Respectfully submitted,

THEODORE HORTON,

Chief Engineer

ALBANY, N. Y., *September* 3, 1915

The plans were approved on September 3, 1915, in accordance with the above recommendations.

BINGHAMTON

Plans for sewer extensions in the streets listed below have been approved during the past year. The permits issued in connection with the approval of these plans contain in addition to the usual revocation and modification clauses the following condition:

That this permit shall expire on October 1, 1917, unless this time shall be extended by the State Commissioner of Health.

Date of Approval 1915		Location of Sewer	Stream receiving sewage
April	8.	Manier avenue and Beethoven street....	Susquehanna river.
June	16.	Frederick street	Chenango river.
June	2.	Wilson and Mozart streets and Jefferson avenue	Susquehanna river.
June	2.	Wilson and West streets and Brownell avenue	Chenango river.
July	23.	Kneeland and Phinn's avenues and Hill street	Susquehanna river.
Sept.	17.	Phelps avenue	Chenango river.
Oct.	13.	Charlotte street	Chenango river.
Nov.	26.	McNamara street	Susquehanna river.
Nov.	26.	Stone street	Susquehanna river.

BRIARCLIFF MANOR

Hermann M. Biggs, M.D., *State Commissioner of Health*:

Plans for sewerage and sewage disposal for Briarcliff Manor, Westchester county, were submitted to this Department for approval by the village on February 19, 1915.

The records of the Department show that a large portion of the eastern section of the village draining into Pocantico river is provided with sewers and a sewage disposal plant consisting of five septic tanks, pumping station and absorption field constructed and maintained by the Briarcliff Manor Realty Company. On Nevember 23, 1914, revised plans for sewerage and sewage disposal for the Briarcliff Manor Realty Company were approved. These plans provided for abandoning the existing pumping station and absorption field for the construction of a new pumping station, intermittent sand filters and absorption field to be located near the site of the old absorption field on a knoll near the intersection of Long Hill road and the State road. Reference is made to our report on the examination of these plans dated October 27, 1914, for a more detailed discussion of the existing sewers and sewage disposal system.

The plans for the entire village now submitted were prepared by Mr. Clyde Potts, civil and sanitary engineer, New York city, and comprise duplicate blue prints of the following plans:

1. A large sewer map of the village.
2. Six sheets of profiles showing depths of sewers on the various streets.
3. Two sheets of details showing sewer appurtenances.
4. Six sheets showing the pumping station and sewage disposal works to be located on the Pocantico river, and the sewage disposal works to be located near the Scarborough station on the Hudson river.

Duplicate copies of the reports and specifications were also submitted.

The plans show the village divided into two main drainage areas, one draining into the Hudson river and the other into the Pocantico river. There are also two or three smaller sections which drain towards the sewer system of the village of Ossining and the report of the designing engineer recommends that arrangements be made with the village of Ossining to care for the sewage from these smaller sections.

The plans provide for a comprehensive sewer system covering practically all portions of the village and for two sewage disposal plants, one near the Scarborough Railroad station serving the Hudson river drainage area, and the other near the Pocantico river above the reservoir of the Consolidated

Water Company of Suburban New York. According to the data submitted by the designing engineer it is planned to use as many of the existing sewers of the village as possible and to incorporate them in the proposed system. The pumping station and all portions of the existing disposal plants owned by the Briarcliff Manor Realty Company, excepting the upper settling tank near the Stafford laundry, are to be abandoned. This upper tank is to be retained to treat the sewage from the laundry before it is discharged into the proposed trunk sewer.

It is also stated by the designing engineer that the sewer system on the Pocantico river watershed has been so designed as to make it possible to convey the sewage from this system by gravity flow to a point below the dam at the lower end of Pocantico lake and to treat the sewage at a point below the reservoir of the water company provided satisfactory arrangements can be made with the company to run a sewer line through their property. This question should be given serious consideration by the village and it might be possible for them to secure the cooperation of the water company in this matter, inasmuch as placing the disposal plant below their dam would remove to a considerable extent a serious menace to the water supply. It may be stated that the water furnished by this company to the village of North Tarrytown and other municipalities in that vicinity is filtered by means of mechanical pressure filters and treated with hypochlorite of lime.

The proposed sewers provided for by the present plans vary in size from 8 to 18 inches in diameter. The slopes of all sewers except the main trunk lines along the Pocantico river are very steep. The trunk lines along the river are to be constructed with minimum slopes. It is probable, however, that no difficulty will be experienced from clogging if these sewers are properly constructed, inasmuch as a velocity of 2 feet per second should be obtained in them when flowing full or half full. The maximum spacing of manholes, moreover, is not more than 400 feet on the trunk sewers, which should provide adequate facilities for cleaning and inspection. The combined capacity of the outfall sewers of the village as designed will be 6,000,000 gallons per day when flowing full and should be adequate to care for the population of from 20,000 to 30,000 people, which population will probably not be exceeded within the life of the sewer system.

It is important that the joints of these sewers which are to be constructed along the river should be made as tight as possible, not only in order to prevent excessive infiltration of ground water but also to meet the rules and regulations for the protection from contamination of the water supply derived from the Pocantico river. In order to properly meet these conditions all sewers within 300 feet of the Pocantico river should be constructed of cast iron pipe with leaded joints.

The sewers to be constructed at present covering the more developed sections of the village are shown by red lines and permission is asked by the village to temporarily omit the construction of the portions of the sewer system not shown by red lines. I would recommend that this application be granted inasmuch as the sewers to be constructed at first in connection with the existing sewers cover the greater portion of the built up section of the village both on the Pocantico and Hudson river watersheds.

It is proposed to treat the sewage from the western portion of the village in a sewage disposal plant consisting of a pumping station and three settling tanks to be located on the bank of the Hudson river near the Scarborough railroad station. Each tank is to be 70 feet long, 12 feet wide and from 7 to 10 feet deep below the flow line, giving a capacity of 50,000 for each tank. Based on a per capita rate of sewage contribution of 100 gallons per day and a detention period of 8 hours, each tank will care for a population of 1,500 persons.

It is proposed to operate the tanks alternately. According to the report of the designing engineer, one tank is to be operated until the accumulation of sludge and scum in the tank reduces its settling capacity and increases the velocity of flow in the tank beyond the point where efficient sedimentation cannot be obtained, at which time the tank is to be cut out of service and

one of the other tanks put in operation. The tank which has been in operation will then be allowed to stand full for a period of from six months to a year in order to allow the sludge to become thoroughly digested and decomposed before it is removed.

Except as noted above no definite statement is made as to the length of time that each tank is to be operated continuously before being cut out of service. It is important for the successful operation of the plant that no one tank shall be in use long enough to reduce its efficiency and unless the plant is to be operated under constant and intelligent supervision I am of the opinion that no tank should be operated continuously for more than one year at a time.

The effluent from the settling tanks is to be discharged by gravity flow into the Hudson river through a 6-inch cast iron pipe at a point about 50 feet from the shore. The outlet end of the pipe is to be submerged 5 feet at low tide. The plans show that provisions are to be made in the construction of the outlet pipe to treat the effluent with chlorine gas should such additional treatment of the sewage be required in the future. Although the New York Central railroad tracks run close to the shore in this vicinity and although there are no houses between the railroad and the river, except the railroad station, it may become necessary after the western portion of the village is more fully developed, to provide for the sterilization of the effluent and the extension of the outlet pipe further out into the stream. Owing, however, to the isolated location of the outlet, the comparatively small amount of sewage to be discharged at first and to the large dilution afforded by the Hudson river no objectionable conditions should be created by the discharge of effluent from this plant into the river at this time.

The sludge is to be removed from the tank to a sludge well to be constructed in connection with the pumping station adjacent to the settling tank. The sludge pipe, which connects with the low points in the tank, is shown to be 10-inch vitrified tile pipe. The T connections between each tank and the sludge pipe are to be fitted with a plug valve to control the discharge from the tank. This pipe, which is to be located under the tank where it would be liable to become crushed due to excessive pressure caused by uneven settlement and where it would not be readily accessible for repairing, should be constructed of specially coated cast iron pipe.

The pumping station is to be equipped with a 6-inch centrifugal pump driven by an electric motor and specially designed to handle sludge. A bar screen is to be placed in front of the suction pipe for the purpose of protecting the pump. The report of the Designing Engineer states that the sludge is to be pumped into a scow and suitably disposed of. Although not stated it is presumably contemplated to discharge this sludge into some body of water. This sludge should not however, be allowed to be discharged into the Hudson river or its tributaries and if towed out to sea should not be discharged within 5 miles of any shore.

As noted above the sewage from the eastern portion of the village is to be treated in a separate sewage disposal plant consisting of 3 settling tanks, a pumping station, dosing and chlorination chamber, 4 intermittent sand filters and sludge drying beds to be located near the intersection of Long Hill road and the State road.

The present population to be cared for by this plant not including the Briar Cliff Lodge, the sewage from which is to be diverted to the Hudson river sewer system, is about 700. The sand filters have been designed to care for a population of 1,000 and the letters received from the Designing Engineer in reference to the plans on March third states that sufficient area is to be acquired by the village to at least double the capacity of the filter beds. The settling tanks and pumping station are designed to care for a population of some 2,500 or 3,000.

The settling tanks and pumping station are to be located on a narrow strip of land between the State road and the Putnam Division railroad tracks about 600 feet north of Long Hill road. The settling tanks are of similar design to the tanks near the Scarborough station. Each tank is to be 90 feet

long, 14 feet wide, from 7 to 10 feet deep below the flow line and has a capacity of about 75,000 gallons. One tank will therefore give a detention period of about eight hours when serving a population of about 2250 persons on the basis of a daily per capita rate of sewage contribution of 100 gallons. These tanks are also shown provided with a vitrified tile sludge pipe. The tile pipe should be replaced by a cast-iron pipe as in the case of the other plant.

These settling tanks are also to be operated in rotation and the sludge from the tanks when decomposed is to be pumped to two sludge drying beds located near the sand filters. Each of the sludge beds is to be 50 feet square and is to be provided with filtering material consisting of a 6-inch layer of broken stone underlying a layer of sand 12 inches in depth. The underdrains are to consist of lines of 4-inch tile laid with open joints and spaced 4 feet center to center. These drains are to discharge into an 8-inch collecting drain leading to the distributing chamber of the sand filters.

From the settling tank the settled sewage is to be discharged into a suction well on the pumping station located adjacent to the settling tanks. This well has a capacity of 10,000 gallons. The pumping station is to be equipped with 3 centrifugal pumps having a capacity of 750 gallons per minute each. Two of the pumps are to be driven by electric motors and the other by means of a gasoline engine. The pumps operated by electricity are under ordinary conditions to pump sewage and the pump driven by the gasoline engine is to pump sludge except in the case of a temporary break down of the central power plant at which time it is planned to have this pump handle sewage.

The settled sewage from the settling tanks is to be pumped against a static head of about 15 feet through some 800 feet of 6-inch cast iron pipe to the dosing or distributing chamber located on a knoll at the site of the existing absorption field operated by the Briarcliff Manor Realty Company. This distributing chamber is designed to distribute the sewage automatically to the 4 filter beds in rotation. The distributing apparatus consisting of 4 valves is operated by cams on a shaft which is actuated by a float.

The filtering material of each filter is to consist of a top layer of sand 3 feet in depth and a lower layer of gravel 7 to 10½ inches in depth. The distributing system is to consist of a trough 24 to 8 inches in width. The beds are to be underdrained by means of lines of 4-inch laterals laid with open joints and spaced 6 feet center to center. These drains are to discharge into a 12-inch central collecting drain which connects with a main drain leading to the chlorination chamber to be constructed in connection with the distributing chamber.

The beds will have an area of about 1⅓ acres and when operated at the rate of 75,000 gallons per acre per day will care for about 1,000 persons, which is about 50 per cent. more than the present population tributary to the plant not including the Lodge. The proposed rate of operation should not be exceeded and when the population tributary to the plant exceeds 1,000 persons additional filters should be constructed.

The effluent from the filter is to be treated with chlorine gas before being discharged into the Pocantico river and although a measuring device designed to automatically register the amount of flow discharged from the plant is provided, no statement is made as to the amount of chlorine to be used in treating the effluent. Owing to the close proximity of the outlet to the reservoir of the Consolidated Water Company of Suburban New York, which is located about 1½ miles below the point of discharge, not less than 5 parts of chlorine per million gallons of effluent treated should be used.

In conclusion I would state that it is found from our careful examination of the plans that the proposed sewer systems and sewage disposal works if properly constructed and if maintained with care and efficiency should satisfactorily care for the sewage of the village and that the effluent might safely be discharged into the Pocantico river and Hudson river without objection at this time.

I would therefore recommend that the plans be approved and a permit be

issued allowing the discharge of effluent from the proposed sewage disposal plants and that the permit contain in addition to the usual revocation and modification clauses the following conditions:

1. That the settling tanks shall be operated continuously for a period of not more than one year at a time.
2. That the sludge pipes of the settling tanks shall be constructed of cast iron pipe.
3. That the number of persons served by the filters of the Pocantico river plant shall be limited to 1,000.
4. That not less than 5 parts of available chlorine per million shall be properly applied at all times to the effluent from the sand filters at the Pocantico river plant.
5. That the sewer tributary to the Ossining sewer system in Pleasantville road below the intersection of Pleasantville road and Briarcliff road to the first manhole below the Ossining reservoir shall be constructed of cast iron pipe.
6. That the outfall sewer and all other sewers constructed at points within 300 feet of Pocantico river shall be laid with cast iron pipe with watertight joints.
7. That whenever required by the State Commissioner of Health the effluent from the Scarborough plant shall be treated with chlorine and the effluent pipe extended.
8. That no sludge from the Scarborough plant shall be discharged into the Hudson river or any other watercourse nor into any other body of water at points less than 5 miles from shore.

Respectfully submitted,

THEODORE HORTON,
Chief Engineer

ALBANY, N. Y., *March* 4, 1915

PERMIT

Application having been duly made to the State Commissioner of Health, as provided by Section 77 of Chapter 49 of the Laws of 1909, the "Public Health Law," as amended by Chapter 553 of the Laws of 1911, constituting Chapter 45 of the Consolidated Laws, permission is hereby given to the Municipal Board of the village of Briarcliff Manor to discharge effluent from the proposed sewage disposal works to be constructed in connection with the village sewer system, into the waters of the Pocantico river near the intersection of State and Long Hill roads within the town of Mount Pleasant in accordance with the plans accompanying the petition, under the following conditions:

1. That this permit shall be revocable at any time or subject to modification or change when in the judgment of the State Commissioner of Health such revocation, modification or change shall become necessary.
2. That the issuance of this permit shall not be deemed to affect in any way action by this department on any future application that may be made for permission to discharge additional sewage or effluent into the waters of this State.
3. That both the sewer system and the sewage disposal works shown by plans approved this day shall be fully constructed in complete conformity with such plans or approved amendments thereof.
4. That only sanitary or domestic sewage, and no storm water or surface water from streets, roofs or other areas shall be admitted to the proposed sewers.
5. That no sewage sludge from any part of the disposal works shall be discharged into the Pocantico river or any other watercourse or body of water.

6. That the number of persons served by the filters shall be limited to 1,000.

7. That the settling tanks shall not be operated continuously for periods of more than one year; and that the sludge pipes of the settling tanks shall be constructed of cast iron pipe.

8. That not less than 5 parts of available chlorine per million shall be properly applied at all times to the effluent from the sand filters at the Pocantico river plant.

9. That the sewers intended to be tributary to the Ossining sewer system in Pleasantville road between the intersection of Pleasantville road and the Briarcliff road and the first manhole below the Ossining reservoir shall be constructed of cast iron pipe with watertight joints.

10. That the outfall sewer and all other sewers constructed at points within 300 feet of Pocantico river shall be laid with cast iron pipe with watertight joints.

LINSLY R. WILLIAMS,
Deputy State Commissioner of Health

March 8, 1915

HERMANN M. BIGGS, M.D., *State Commissioner of Health*:

Plans for the extension of the outfall sewer at Braircliff Manor to a point below the Pocantico dam and for the construction of filter beds at that point were submitted for approval on August 20, 1915. Formal application for the approval of the plans was made under date of August 15, 1915 by the Municipal Board of Braircliff Manor.

The records of the department show that on November 23, 1914, revised plans for sewerage and sewage disposal for the Braircliff Manor Realty Company providing for abandoning the existing disposal plant and the construction of a new plant were approved. On March 8, 1915, plans for a comprehensive sewer system covering practically all portions of the village and for two sewage disposal plants, one near the Scarborough Railroad Station and the other near the Pocantico river about 1½ miles above the reservoir of the Consolidated Water Company of Suburban New York were approved.

The plans now submitted were prepared by Mr. Clyde Potts, civil and sanitary engineer of New York city and comprise duplicate blue prints of a plan showing the proposed extension of the outfall sewer and proposed change in the location of part of the final disposal plant.

It appears from a letter received from the designing engineer that it is apparently proposed to build the entire plant at State and Long Hill roads in accordance with the plans approved on March 8, 1915, but the settled effluent from the settling tanks is to be ultimately discharged through a 14-inch cast iron sewer to be laid along the Pocantico river and Pocantico lake to sand filter beds below the reservoir dam. The dosing chamber and sand filters are to be constructed in general accordance with the plans approved on March 8, 1915. The present plans provide for this change which will probably not be made for some time in the future.

An examination of the plans now submitted shows that it is proposed to discharge the effluent from the Imhoff settling tanks to be located near the State and Long Hill roads, into a 15-inch tile pipe sewer, which will in turn discharge into a 14-inch cast iron outfall sewer. The outfall sewer is to be laid across the Pocantico and under the New York Central Railroad tracks and will then pass in a generally southwesterly direction across tributaries of the river and the river itself several times and along the western shore of Pocantico lake for a total distance of about 10,925 feet to the proposed disposal site.

The cast iron sewer is to be laid on a slope of 0.10 per cent. and will be provided with manholes to be located 1,000 feet apart. The alignment of the sewer between manholes will follow the curvature of the land and will, therefore, be curved between manholes. However, as the sewage to be conveyed through this sewer will have been clarified by sedimentation and although the sewer for a large part of its length is to be laid on a slope which will not be steep, yet it would appear that little or no trouble should be

experienced with this sewer because of clogging. Great care should be used to make the sewer watertight at all points and especial attention should be given to the river crossings in order that leaks may not occur.

No mention is made of the type of construction to be used for the manholes and details of the construction are not shown on the plans. These manholes should be made watertight and sealed as suggested by me in a conference with the designing engineer. A valve is to be provided in the sewer to be used in case of a stoppage occurring below the valve.

The sand filters are to be located on the western bank of the Pocantico river about 450 feet below the dam. The letter of the engineer states that the filters are to be constructed in accordance with the plans approved by this department and computing the respective elevations of different parts of the structure from the given elevation of the inlet of the dosing chamber, it appears that there will be little danger of flooding of the sand filters, especially as the flow in the stream will be controlled by the dam just above. The effluent from the sand filters is to be discharged directly into the Pocantico river without further treatment. The engineer's report also states that the original site is to be retained after the completion of the proposed plant in order to care for any flow of sewage in excess of the capacity of the 14-inch sewer that may occur.

In view of our examination of these plans and after careful consideration of the local requirements for the proper disposal of sewage from that part of the village of Briarcliff Manor which is contributory to this disposal plant, it appears that if the proposed outfall sewer is properly constructed and the disposal works are built in accordance with the plans approved by this department, that the proposed outfall sewer and disposal works should prove adequate to dispose of the sewage and should provide adequate protection for the water supply obtained from Pocantico lake.

I would, therefore, recommend that the plans be approved on the following conditions:

1. That the outfall sewer be made watertight throughout, including watertight manholes.
2. That the sand filters to be located below the Pocantico dam be constructed in accordance with the plans approved on March 8, 1915 for sand filters to be located at the State and Long Hill disposal works.

Respectifully submitted,

THEODORE HORTON,
Chief Engineer

ALBANY, N. Y., *October* 4, 1915

PERMIT

Application having been duly made to the State Commissioner of Health, as provided by section 77 of chapter 49 of the Laws of 1909, the "Public Health Law," as amended by chapter 553 of the Laws of 1911, constituting chapter 45 of the Consolidated Laws, permission is hereby given to the Municipal Board of Briarcliff Manor to discharge effluent from the proposed sewage disposal works for the village into the waters of Pocantico river below Pocantico lake within the town of Mount Pleasant in accordance with the plans accompanying the petition, under the following conditions:

1. That this permit shall be revocable at any time or subject to modification or change when in the judgment of the State Commissioner of Health such revocation, modification or change shall become necessary.
2. That the issuance of this permit shall not be deemed to affect in any way action by this Department on any future application that may be made for permission to discharge additional sewage or effluent into the waters of this State.
3. That both the sewers and the sewage disposal works shown by plans approved this day and by plans approved on March 8, 1915, shall be

constructed in complete conformity with such plans or approved amendments thereof and that the sand filters to be located below Pocantico lake be constructed in accordance with the plans for sand filters at the then proposed State and Long Hill sewage disposal works for which plans were approved by this Department on March 8, 1915.

4. That only sanitary or domestic sewage, and no storm water or surface water from streets, roofs or other areas shall be admitted to the proposed sewers.

5. That no sewage sludge from any part of the disposal works shall be discharged into the Pocantico river or any other watercourse or body of water.

6. That the outfall sewer and all manholes on the outfall sewer shall be made watertight throughout.

LINSLY R. WILLIAMS,
Deputy State Commissioner of Health

October 13, 1915

BROCKPORT

HERMANN M. BIGGS, M.D., *State Commissioner of Health*:

Plans for an additional sewage disposal plant for the village of Brockport, Monroe county, were submitted to this Department for approval by the Board of Trustees on May 3, 1915.

The records of the Department show that original plans for sewerage and sewage disposal were approved on May 14, 1901. The sewage disposal plant of the village, however, was constructed under revised plans approved on October 20, 1903. This disposal plant, which was constructed soon after the approval of the plans, is located in the northern part of the village on a small stream tributary to Salmon creek and consists of a settling tank, dosing chamber, four contact beds and four wave beds.

An inspection made by a representative of this Department on August 5, 1914, in connection with the general investigations of sewage disposal plants in the State now being carried on, showed that the plant, as a whole, was out of repair, was not operating in accordance with its intended design, and was apparently badly neglected and giving a very low efficiency of operations and an unsatisfactory effluent, and that, as a result of the low efficiency of the plant and the unsatisfactory quality of the effluent, a serious condition of pollution of the stream into which the effluent is discharged was created as indicated by the putrescibility of the water of the stream, the growths and deposits of sewage fungi in and along the brook below the point of discharge. It was, therefore, recommended that the plant be at once thoroughly overhauled, the tank, contact beds, and wave beds cleaned, and that such other repairs, alterations, or additions as will enable the plant to be properly operated, be made.

The plans now presented which were submitted in compliance with the above recommendations were prepared by Charles C. Hopkins, Civil Engineer of Rochester, N. Y., and comprise blue prints of the following sheets in duplicate:

1. General topography map of disposal plant site showing existing and proposed disposal plant.
2. One sheet showing plan, cross sections, and detail of proposed settling tank and plan of dosing chamber.
3. One sheet showing details of settling tank, dosing chamber, sprinkling filter, and sludge drying bed.

The report of the engineer submitted with the plans states that preliminary estimates of costs showed that an additional plant built without disturbing the old plant along the lines proposed would cost about 18 per cent. more than altering the present plant and that it was, therefore, decided to construct a new plant by the side of the present plant and not to disturb

the old plant during the construction. The report also states that, after the proposed plant is constructed, it is planned to put the present plant in proper operating condition by cleaning and repairing the settling tank, cleaning the filtering material in the contact and wave beds, repairing the walls of these structures, and putting the dosing apparatus in condition. It is also stated that it is proposed to install an adjustable weir or orifice in the first manhole west of the existing settling tank in order to permit of diverting about 125,000 gallons of the daily flow of sewage to the present plant, which amount, it is assumed by the designing engineer, this plant should be capable of treating after being repaired. It appears, however, that the new plant is to care for all of the sewage of the village until the present water consumption and the population served by the sewer system will be considerably increased.

Gaugings made by the engineer during March of this year indicate that the present average daily flow of sewage is 371,000 gallons of which 225,000 gallons is estimated to be ground water. It was found from the inspection made by this Department last year that about 60 per cent. of the village is served by the sewer system. The new disposal plant is designed to care for a flow of 515,000 gallons of sewage per day and 125,000 gallons is to be treated in the old plant. The two plants will therefore care for an ultimate flow of 640,000 gallons. The designing engineer estimates that of this flow 225,000 gallons will be ground water and that the remainder of 415,000 gallons will be domestic sewage contributed by an estimated population of 5,200 persons contributing sewage at the average rate of 80 gallons per day.

The proposed disposal plant is to consist of a settling tank of the Imhoff type, dosing chamber, sprinkling filter, and sludge drying bed and is to be located on the bank of the small stream tributary to Salmon creek. This stream has a drainage area above the plant of about 2½ square miles. The flow of the stream on August 6, 1914, was 1½ cubic feet per second and this comparatively high flow for that time of the year was attributed to leakage from the State Barge Canal. Although no water supply is taken from this stream below the plant, it flows through the unincorporated villages of Clarkson and Hilton and discharges into Lake Ontario near Manitou Point about thirteen and one-half miles below Brockport. Clarkson is located about one mile and Hilton about nine miles below Brockport.

Settling tank

The proposed settling tank is to be a covered horizontal flow tank of the Imhoff type, 34 feet in diameter, 30 feet, 10 inches deep inside dimensions and will have a depth of 27 feet 10 inches from the flow line to the bottom of the sludge compartment. It is divided by means of reinforced concrete partitions into a single upper settling compartment provided with two parallel channels and baffled slots which communicate with a single lower hopper-shaped sludge compartment. A six-inch galvanized sludge pipe provided with a six-inch stop valve extends from a point near the bottom of the sludge compartment to a sludge bed located about 120 feet from the tank. A clean out branch of the sludge pipe extends above the flow line of the tank. The outlet of the sludge pipe at the tank is five feet below the flow line, and the elevation of the sludge bed is nine feet below the flow line of the tank.

The settling compartment of the tank has a capacity of 52,000 gallons and will, therefore, give an average time of detention of sewage of about 3½ hours with the present flow of 371,000 gallons and a detention period of about 2.4 hours when treating the estimated ultimate future flow of 515,000 gallons per day. The sludge compartment has a capacity of about 3600 cubic feet and will, therefore, give about six months storage for the sludge when serving the present population.

It appears, therefore, that the settling tank is of ample capacity to care for the estimated population of the village. There are, however, certain features in connection with the design of the plant which, if modified, would increase its efficiency. In the first place, the sewage before being discharged into the tank should be passed through a small screen chamber provided with an inclined bar screen composed of bars spaced from 1½ to 2 inches apart

in the clear in order to remove sticks and other large substances which would be likely to clog the sludge pipes.

The covering of the tank, which is to be of concrete and provided with eight rectangular openings 1 foot 8 inches by 2 feet 2 inches, should be removed as it will interfere with the proper maintenance of the tank. Although the openings of the cover are shown over portions of the tank which it may be desired to inspect or enter, the tank is not readily accessible for the removal of scum and the cleaning and flushing of the sloping partitions of the settling compartments. It has been found in the inspection of sewage disposal plants in the State now being carried by the Department that settling compartments of a number of covered tanks of this type were partially filled with scum which interfered seriously with their operation. The proposed tank should either be open or, if it is considered necessary or desirable to have it covered, the covering should be so designed as to be entirely removable. In either case, the tank should be surrounded by a fence.

The sludge pipe of the tank should be increased in size to eight inches in diameter not only for the purpose of better preventing clogging of the sludge pipe, but also to facilitate the removal of the sludge by causing the sludge to flow toward the sludge pipe with a rush when the sludge valve is opened. The sludge pipe should also be made of cast-iron pipe in order to better withstand the corrosive effect of sewage and it should be continued on a straight line from the bottom to the top of the tank to permit of inspecting and cleaning the pipe. The removal of the sludge from the tank should be further facilitated by providing the sludge compartment with one or two rings of perforated lead water pipe through which water under pressure may be discharged into the sludge and thereby loosen it during its removal as it is liable to become caked on the bottom of the tank if not removed for a considerable time during the winter.

Dosing tank

From the settling tank the effluent is to flow through a three-inch by six foot opening protected by a scum board into a dosing chamber to be located adjacent to the outlet end of the tank. This dosing chamber, which is to be rectangular in plan and provided with a hopper-shaped bottom is to contain a 12-inch automatic discharge siphon by means of which the settled sewage is to discharge intermittently into the distributing system of the sprinkling filter. The maximum and minimum differences of elevation between the water surface of the dosing tank and the nozzles of the sprinkling filter as shown are five feet and one foot respectively. It would be better to increase the minimum head to 1½ or 1¾ feet if possible and this could be done by providing for a lower drawing depth of the siphon. Even with this increase of the minimum operating head, a 14-inch siphon and preferably a 16-inch siphon should be substituted for the proposed 12-inch siphon in order to insure proper intermittent operation of the siphon when the maximum estimate rate of flow, on which the design of the plant is based, is reached.

Sprinkling filter

This filter is to be constructed with concrete sides and a concrete bottom and is to be 75 feet long by 166 feet wide giving an area of .286 acres. It is to be filled to an average depth of six feet with broken stone ranging in size from 1½ to 2 inches. The distributing system is to consist of a 10-inch cast iron main distributor, 6-inch wrought-iron laterals, spaced 15 feet apart and 3-inch wrought-iron risers also spaced 15 feet apart to which are to be attached spray nozzles. The collecting or underdrain system is shown to consist of parallel lines of six-inch half tile laid eight feet apart and discharge into a 12-inch main collecting drain which is shown discharging directly into the stream near the plant.

The filter, if constructed as proposed, would be operated at a rate of 1,200,000 gallons per day when serving the present population of 3,600 persons assuming a per capita rate of sewage contribution of 100 gallons per day. On the same assumption as to per capita rate of sewage contribution,

which is the rational basis of design of filters inasmuch as within reasonable limits it is more a question of organic content of the sewage than rate of flow that has to be considered in organic purification of sewage, and assuming since the present plant when remodeled will care for about 1,000 persons, the is a very liberal allowance considering the past growth of the village, and since the present plant when remodeled will care for about 1,000 persons, the ultimate rate of operation will be about 1,400,000 gallons per acre per day. It appears, therefore, that the present filter is 25 per cent. larger than necessary inasmuch as filters of this type with the depth shown should be able to treat domestic sewage at the rate of 1,800,000 gallons per acre per day.

It is found that the proposed spacing of the nozzles of 15 feet is excessive for the low head under which they are to operate and that in order to obtain a uniform distribution of sewage over the filters, which is essential to the successful operation of filters of this type, the nozzles should be spaced not more than ten feet apart and, unless square spray nozzles are to be used, it would be better to stagger the nozzles so as to form equilateral triangles. A false floor underdrain system should also be provided in order to give better drainage and ventilation of the filters.

As noted above, it is planned to discharge the effluent from the sprinkling filter directly into the stream without any additional treatment. Owing, however, to the small size of the stream and to the nature of the territory through which it flows the effluent should be passed through a short-period detention settling tank in order to remove the humus which is given off from filters of this type and which, if not removed, would settle along the bottom of the stream and probably create a nuisance during certain seasons of the year.

From our careful examinations of plans, it is found that in general the plant has been designed to meet the local requirements for sewage disposal. Owing, however, to the nature of the stream into which the effluent is discharged which requires that a stable effluent shall be produced and that there shall be no deposits along the banks of the stream, it is necessary that the plant be constructed and operated as efficiently as practicable. In order to obtain these conditions, the plans for the proposed disposal plant should be modified along the lines indicated above.

I would, therefore, recommend that the plans be returned for additions or modifications in the following respects:

1. That a screen chamber provided with a coarse bar screen be installed at the head of the settling tank.
2. That the proposed cover of the settling tank be omitted entirely or that a cover which may be readily removed be substituted for it.
3. That the sludge pipe should be of cast-iron not less than eight inches in diameter and be straight above the bottom and top of the tank.
4. That one or more rings of perforated lead water pipe be installed in the sludge compartment.
5. That the minimum head on the nozzles be increased to not less than 1½ feet and preferably 1¾ feet.
6. That the size of the siphon be increased to not less than 14 inches and preferably to 16 inches.
7. That the spacing of the nozzles be not more than ten feet or that the head on the nozzles be increased to not less than eight feet.
8. That a false floor underdrain system be provided in the sprinkling filter.
9. That a final settling tank be provided and shown by the plans.
10. That the effluent pipe be so extended into the stream as to be submerged at all stages of flow.
11. That the average and maximum elevations of the stream be shown on the plans.

Respectfully submitted,

THEODORE HORTON,

Chief Engineer

ALBANY, N. Y., *May* 13, 1915

The plans were returned to the designing engineer for revision on May 13 in accordance with the above recommendations.

HERMANN M. BIGGS, M.D., *State Commissioner of Health:*

Amended plans for sewage disposal for the village of Brockport, Monroe county, were submitted to this Department by the board of trustees on June 14, 1915.

These plans were first submitted for approval on May 3, 1915, and were given a careful examination by the Engineering Division. It was found from this examination of the plans that although they had in general been designed to meet the local requirements for sewage disposal, there were certain modifications that should be made in them in order to increase the efficiency of the design of the plant, as pointed out in our report dated May 13, 1915. The plans were accordingly returned to the designing engineer on May 25, 1915, with the recommendation that the plans be modified in the following respects:

1. That a screen chamber provided with a coarse bar screen be installed at the head of the settling tank.
2. That the proposed cover of the settling tank be omitted entirely or that a cover which may be readily removed be substituted for it.
3. That the sludge pipe should be of cast-iron not less than eight inches in diameter and be straight above the bottom and top of the tank.
4. That one or more rings of perforated lead water pipe be installed in the sludge compartment.
5. That the minimum head on the nozzles be increased to not less than 1½ feet and preferably 1¾ feet.
6. That the size of the siphon be increased to not less than 14 inches and preferably to 16 inches.
7. That the spacing of the nozzles be not more than ten feet or that the head on the nozzles be increased to not less than eight feet.
8. That a false floor underdrain system be provided in the sprinkling filter.
9. That a final settling tank be provided and shown by the plans.
10. That the effluent pipe be so extended into the stream as to be submerged at all stages of flow.
11. That the average and maximum elevations of the stream be shown in the plans.

The plans now submitted show that they have been revised in general accordance with all of the above recommendations. A screen chamber 6 feet long, 3 feet wide and 3 feet 2 inches deep, inside dimensions, is to be provided near the inlet end of the primary settling tank. This chamber is to be provided with a bar screen, three feet wide, composed of 1½-inch by ¾-inch wrought iron bars spaced 1½ inches in the clear, through which the sewage is to be passed before entering the settling tank.

The proposed concrete cover over the settling tank is to be omitted and three "I" beams are to be installed, which are intended to support a removable cover over the tank should it be found necessary or desirable to provide such a cover in the future. The sludge pipe in the settling tank has been increased in size from 6 to 8 inches in diameter, and is to be constructed of flanged cast-iron pipe. A flushing ring consisting of 2-inch lead pipe provided with ¼-inch holes spaced 12 inches center to center is also to be installed in the sludge compartment in the tank near the junction of the vertical side walls and the sloping bottom of the tank. This pipe is to be connected with the village water main.

The size of the dosing siphon has been increased to 16 inches and the minimum head under which it will operate has been increased to 21 inches as recommended. The plans, however, show that it is proposed to reduce the size of the 16-inch pipe of the siphon to 12 inches at the dosing tank and to extend the 12-inch pipe, which will act as a main distributor, through the sprinkling filter. The discharge pipes from the siphon if reduced as proposed would retard the discharge of the siphon and would also cause a considerable

loss of head, which is not desirable owing to the limited operating head available. The main distributor should in no case be less than the size of the siphon — 16 inches in this case.

The spacings of the spray nozzles have been reduced from 12 feet 8 inches to 10 feet, and they are so placed as to form equilateral triangles and should give uniform distribution of the sewage over the surface of the sprinkling filter. A false floor consisting of 6-inch channel pipe is also to be provided for the sprinkling filter and this floor is to be covered to a depth of from 6 to 8 inches with large stone in order to facilitate drainage and aeration of the filter. The area of the sprinkling filter has also been reduced from 75′ x 166′ to 70′ 8″ x 150′ 4″ or from .286 acres to .244 acres. The filter of this size and depth should care for the sanitary sewage of a population of some 4,300 persons.

A final settling tank has also been added to the plant. This tank is circular in plan, 20 feet in diameter, and is to be constructed with a sloping bottom. The depth of the tank will vary from 11 to 16 feet below the flow line. It will have a capacity of about 30,000 gallons and will give an average detention of about 1.4 hours with a daily flow of 515,000 gallons. The sludge is to be removed from this tank and discharged into the preliminary settling tank by a centrifugal pump having a four-inch suction and a 3-inch discharge pipe. The pump is to be operated either by a gas engine or electric motor. The pump and engine are to be located in a small brick building over the settling tank.

It is found in general that the amount of sludge obtained from final settling tanks treating sprinkling filter effluent is equal in volume to about 50 per cent of the sludge obtained from primary settling tanks. As noted in our previous report, on the examination of the plans the primary settling tank has a sludge capacity of about 3,600 cubic feet, which should give about 6 months' storage of the sludge deposited by the raw sewage when serving the present population. In order, therefore, to obtain a 6 months' detention of sludge under the proposed conditions it will be necessary to increase the capacity of the sludge compartment of the settling tank by not less than 50 per cent inasmuch as it will be necessary for this tank to provide storage for the sludge deposited from the sprinkling filter effluent as well as by the crude sewage.

The effluent pipe from the final settling tank is to extend to the creek and the end of the pipe is to be submerged at all stages of flow. The maximum and average elevations of the stream are shown to be 457 and 455 respectively and the elevation of the flow line of the final settling tank is 457, so that it appears that the operation of the plant will not be interfered with by reason of high water stages of the stream.

In conclusion I would state that it is found from our examination of the plans that they are revised in general accordance with the recommendations of our previous report and that the proposed sewage disposal plant, if properly constructed and operated, should satisfactorily care for the present population and allow for a reasonable increase in the future and should produce an effluent that may be discharged into the creek without objection at this time. There are, however, certain features in connection with the plant which should be modified, and I would therefore recommend that the plans be approved and a permit be issued allowing the discharge into the tributary of Salmon creek of effluent from the proposed sewage disposal plant on the following conditions.

1. That the size of the main distributor of the sprinkling filter be increased to not less than 16 inches in diameter.
2. That the capacity of the sludge compartment of the primary settling tank be increased by not less than 50 per cent.

Respectfully submitted,

THEODORE HORTON,
Chief Engineer

ALBANY, N. Y., *June* 21, 1915

PERMIT

Application having been duly made to the State Commissioner of Health, as provided by section 77 of chapter 49 of the Laws of 1909, the "Public Health Law," as amended by chapter 553 of the Laws of 1911, constituting chapter 45 of the Consolidated Laws, permission is hereby given to the board of trustees of the village of Brockport to discharge effluent from the proposed new sewage disposal plant into the waters of a tributary of Salmon creek at the point shown by the plans within the municipality of Brockport, in accordance with the plans accompanying the petition, under the following conditions:

1. That this permit shall be revocable at any time or subject to modification or change when in the judgment of the State Commissioner of Health such revocation, modification or change shall become necessary.
2. That the issuance of this permit shall not be deemed to affect in any way action by this Department on any future application that may be made for permission to discharge additional sewage or effluent into the waters of this State.
3. That the sewage disposal works shown by plans approved this day shall be fully constructed in complete conformity with such plans or approved amendments thereof.
4. That only sanitary or domestic sewage, and no storm water or surface water from streets, roofs or other areas shall be admitted to the proposed sewage disposal works.
5. That no sewage sludge from any part of the disposal works shall be discharged into the tributary of Salmon creek of any other watercourse or body of water.
6. That the main distributor of the sprinkling filter shall be not less than 16 inches in diameter.
7. That the capacity of the sludge compartment of the primary settling tank shall be increased by not less than 50 per cent.

LINSLY R. WILLIAMS,
Deputy State Commissioner of Health

June 23, 1915

HERMANN M. BIGGS, M.D., *State Commissioner of Health:*

Amended plans for the proposed additional sewage disposal works and outlet sewer for the village of Brockport, Monroe county, were submitted for approval by the board of trustees on December 8, 1915.

The original plans for a new or additional sewage disposal works consisting of a screen chamber, settling tank of the Imhoff type, sprinkling filter and final settling tank were approved on June 23, 1915. These plans provided for the construction of the proposed works on the site of the existing sewage disposal plant in the town of Clarkson, north of the Brockport village line, and for the discharge of effluent from these works into a small stream tributary to Salmon creek which empties into Braddock bay, an arm of Lake Ontario near Manitou Point. Reference is made to our previous reports on examination of the plans dated May 13 and June 21, 1915, for a detailed description of the design of the proposed works.

Following the approval of these plants, protests were received from the town of Clarkson against the construction of the new disposal plant at the site of the present plant. It appeared that the residents of Clarkson feared that a nuisance would be created by the discharge of effluent from the disposal works into the small stream which flows through the unincorporated village of Clarkson and that they desired to have the plant located, if possible, below the junction of the two streams which flow through Clarkson about one mile below the present plant.

It was pointed out to the town authorities that, whereas the present disposal plant consisting of septic tanks, contact bed and wave beds had been

operated at the rate of three or four times above the proper rate of operation, the proposed plant had been designed with ample capacity to properly care for the sewage of Brockport without the creation of a nuisance. It was urgently requested by the authorities, however, that an inspection of the local conditions be made by a representative of this Department.

An inspection of the stream and of the present and proposed site of the works was accordingly made by Mr. H. B. Cleveland, principal assistant engineer of the Department, on August 6, 1915. It was found from this inspection that an available site for the disposal works could be found on the Cusick farm below the intersection of the two streams referred to above, but that no special choice existed between the two sites except that the property between Brockport and Clarkson might be developed sooner than the property below Clarkson and that the stream at the present site affords less dilution than the stream at the Cusick farm.

It was pointed out to the village authorities at the time of the inspection that, whereas no nuisance would be expected in the stream after the completion of the new disposal works at the site of the present plant, it would be better, in order to settle beyond question the matter of a nuisance in the stream, to arrange if possible for an extension of the effluent pipe of the works to a point below the junction of the two streams. The engineer for the village, who was present at the conference with the village authorities, stated that he believed that the appropriation to be voted upon by the taxpayers in the near future might be sufficiently in excess of the cost of the plant, by omitting temporarily the final settling tank or making other changes in the works, to admit of an extension of the effluent pipe to a point below Clarkson. The village board was therefore advised to arrange for this extension of the effluent pipe and they were informed that the Department would probably consider the approval of amended plans providing for a somewhat smaller disposal plant than proposed at the present site and possibly the omission of the final settling tank.

The plans now presented show that it is proposed to omit the construction of the final settling tank and to extend the effluent pipe to a point below the junction of the two streams about one-half mile below Clarkson and about one mile below the present site. From the report of the designing engineer submitted with the plans it appears that the proposed changes have been made possible, inasmuch as rights of way for a sewer have, with one exception, been granted without cost to the village and since favorable bids have been received for the new works. It is also stated that the increase of cost by extending the effluent pipe and omitting the final settling tank is estimated at $3,000.

The proposed outlet sewer is to be 12 inches in diameter and is to be constructed with slopes varying from 6 per cent to 2 per cent. It follows the general course of the stream for the greater portion of its length and crosses the creek at five points. It is carried under the creek on uniform slopes in each case without the use of siphons and cast-iron pipe is to be used in the portion of the sewer under each creek crossing.

From our examination of the plans it would appear that the proposed sewer if properly constructed should be of ample capacity to satisfactorily meet the future needs of the village. Owing, however, to the close proximity of the sewer to the creek special care should be taken in its construction to make the joints of the sewer as tight as possible in order to eliminate as far as practicable the infiltration of ground water.

With respect to the omission of the final settling tank, I am of the opinion that if the works are properly constructed and operated with care and efficiency no objectionable conditions should be created in the stream below the proposed point of disposal at present owing to the very ample capacity of the sewage disposal works and to the greater dilution that would be obtained at the proposed point of discharge than at the existing disposal plant site and that it would be reasonable to grant permission to temporarily omit from construction the final settling tank.

I would therefore recommend that the plans be approved and a permit issued allowing the discharge of effluent from the proposed sewage disposal plant into a tributary of Salmon creek in the town of Clarkson at the point of

discharge shown by the plans on condition that whenever required by this Department the final settling tank shown by the plans approved on June 23, 1915, shall be constructed and put in operation.

Respectfully submitted,

THEODORE HORTON,
Chief Engineer

ALBANY, N. Y., *December* 15, 1915

PERMIT

Application having been duly made to the State Commissioner of Health, as provided by Section 77 of Chapter 49 of the Laws of 1909, the "Public Health Law," as amended by Chapter 553 of the Laws of 1911, constituting Chapter 45 of the Consolidated Laws, permission is hereby given to the Board of Trustees of the village of Brockport to discharge effluent from the proposed additional sewage disposal works for the village of Brockport into the waters of a tributary of Salmon creek through the outfall sewer shown by the plans approved this day within the town of Clarkson in accordance with the plans accompanying the petition, under the following conditions:

1. That this permit shall be revocable at any time or subject to modification or change when in the judgment of the State Commissioner of Health such revocation, modification or change shall become necessary.
2. That the issuance of this permit shall not be deemed to affect in any way action by this Department on any future application that may be made for permission to discharge additional sewage or effluent into the waters of this State.
3. That the sewage disposal works shown by plans approved on June 23, 1915 shall be fully constructed in complete conformity with such plans or approved amendments thereof except that the construction of the final settling tank may be deferred; and that this tank shall in the future be constructed and put in operation whenever required by the State Commissioner of Health.
4. That only sanitary or domestic sewage and no storm water or surface water from streets, roofs or other areas shall be admitted to the proposed sewage disposal works.
5. That no sewage or sludge from any part of the disposal works shall be discharged into the tributary of Salmon creek or any other watercourse or body of water.
6. That the main distributor of the sprinkling filter shall be not less than 16 inches in diameter.
7. That the capacity of the sludge compartment of the primary settling tank shall be increased by not less than 50 per cent.

LINSLY R. WILLIAMS,
Deputy State Commissioner of Health

December 20, 1915

BRONXVILLE

HERMANN M. BIGGS, M.D., *State Commissioner of Health:*

Plans for a proposed sewer extension in the village of Bronxville, Westchester county, were submitted to this department for approval by the village engineer on August 16, 1915.

The plans show that it is proposed to construct about 100 feet of 10-inch sewer in Rockwell avenue, extending an existing sewer to Woodland avenue and from the intersection with Rockwell avenue to construct some 900 feet of 8-inch sewer in Woodland avenue to the intersection with Greenfield avenue. Future sewer extensions in Greenfield and Oriole avenues are also shown, but these are apparently not to be included in the present construction.

The 10-inch sewer in Rockwell avenue is to be laid on a slope of 4⅝ per cent., which is ample for a sewer of this size and the slopes of the 8-inch

sewer in Woodland avenue range from a minimum of 6 per cent. to a maximum of 12½ per cent., which are ample. These grades are more than sufficient to provide self cleansing velocities in the sewer and to prevent clogging of the sewer.

A manhole is to be placed at every change of grade and alignment in the proposed sewer and the maximum spacing between manholes is about 345 feet. Ample facilities will, therefore, be provided for inspecting and cleaning the sewer. Although no flush tank is to be placed at the upper end of this sewer, in view of the steep grade of this sewer, it is not probable that clogging will occur in its upper end. The sewage collected by this sewer is to be discharged into the Bronx Valley Trunk Sewer through the sewerage system of the village of Bronxville.

It appears from our examination of the plans that the proposed sewer if properly constructed should satisfactorily care for the sanitary sewage of the section to be served by it. I would, therefore, recommend that the plans be approved.

Respectfully submitted,

THEODORE HORTON,
Chief Engineer

ALBANY, N. Y., *August* 26, 1915

The plans were approved on September 3, 1915.

HERMANN M. BIGGS, M.D., *State Commissioner of Health:*

Plans for a modification of a portion of the sewer system of the villages of Bronxville and Tuckahoe were submitted to this department for approval, jointly by the two villages on August 30, 1915.

The plans show that it is proposed to abandon the existing sewer in Garrett street from the Bronx river to Lake avenue and through private property from Lake avenue to the right of way of the New York Central and Hudson River Railroad, a portion of which line is in the village of Bronxville and the remainder in the village of Tuckahoe and to discharge the sewage tributary to this sewer into the Tuckahoe sewer in Garrett street at Lake avenue. The greater portion of the sewer to be abandoned serves Kensington road, Sagamore road and other streets in the village of Bronxville. The proposed connection between the Bronxville sewers and the Tuckahoe sewer is to be 226 feet long and is to consist of a 10-inch line constructed on a slope of about .4 per cent. The former village engineer who prepared the plans stated when he presented the plans for approval that the probable maximum population to be tributary to this sewer was estimated at 300.

The application stated that it is necessary to make the proposed change in the sewer system in order to clear this portion of the area which has been acquired by the Bronx Valley Park Commissioners. The slope of the existing 8-inch sewer in Garrett street into which the sewage from a portion of Bronxville sewage is to be discharged is not shown by the plans, but a note on these plans states that this portion of the sewer in Garrett street is to be rebuilt at any time that an increased capacity is required. The sewage to be collected by the proposed sewer is to be tributary to the Bronx Valley sewer.

From our examination of the plans it would appear that the proposed sewer connection if properly constructed should satisfactorily care for the sewage from the section to be served by it, and I would therefore recommend that the plans be approved on condition that the existing sewer in Garrett street to which the proposed sewer is tributary, be increased in size whenever necessary or when required by this department.

Respectfully submitted,

THEODORE HORTON,
Chief Engineer

ALBANY, N. Y., *September* 3, 1915

The plans were approved on September 3, 1915.

HERMANN M. BIGGS, M.D., *State Commissioner of Health:*

Plans for proposed sewer extensions in the village of Bronxville, Westchester county, were submitted to this department for approval by the village engineer on behalf of the Board of Trustees on September 1, 1915.

The plans show that it is proposed to extend the existing sewer in Kensington road a distance of 150 feet northerly from the existing manhole at the end of Kensington road sewer. The proposed sewer is to be constructed on a slope of 7.7 per cent and is to be provided with a manhole at its upper end. This sewer is to be tributary to the existing sewer in Pondfield road which discharges into the Bronx Valley sewer.

It is found from our examination of the plans that the proposed sewer if properly constructed should satisfactorily meet the needs of the section to be served by it and I would therefore, recommend that the plans be approved.

Respectfully submitted,

THEODORE HORTON,
Chief Engineer

ALBANY, N. Y., *September* 3, 1915

The plans were approved on September 3, 1915.

CAMDEN

HERMANN M. BIGGS, M.D., *State Commissioner of Health:*

Plans for a separate system of sewerage and sewage disposal works for the village of Camden, Oneida county, covering the whole of the village, were submitted by the Board of Trustees on February 17, 1915. A formal application for the approval of the plans was received on February 8, 1915, and application is also made to omit from construction the sewers on certain streets and also certain parts of the disposal works.

The records of the department show that plans for a system of sewers for the village of Camden received the approval of the State Board of Health on February 8, 1893. On June 4, 1914, a representative of this department made an investigation of the sewerage conditions in Camden and it was found at that time that none of the sewers shown on the plans approved in 1893 had been built. In the report upon this investigation it was recommended that adequate sewerage facilities should be provided for the village and that amended plans for sewerage and sewage disposal should be prepared, submitted to this department for approval and the sewers be built since it was improbable that the plan previously approved would provide adequate sewerage because of the unforeseen lines along which the village had developed.

The plans now submitted were prepared by Morrell Vrooman, civil engineer, and comprise blue prints in duplicate of the following sheets:

1. General plan of sewerage system.
2. General plan of disposal works.
3. Disposal works structural details.
4. Disposal works construction details.
5. Details of inverted siphon manholes.
6. Details of manholes and flush tanks.
7. 4 sheets of profiles of sewers.

The village of Camden is situated in the central eastern part of the town of Camden at the junction of the West branch of Fish creek and Mad river. It is provided with an unfiltered water supply taken from streams and springs and the works are controlled by the municipality. The village is not provided with sewers with the exception of house sewers and storm water drains discharging into the two streams at a number of different points.

The present population of the village according to the census of 1910 is approximately 2,170 and its area 1,085 acres giving a density of about 2 per acre. The population of the village shows an increase up to 1902 when it was 2,482 and a decrease of about 12.5 per cent since that time and it is estimated by the engineer that the population ultimately to contribute sewage from the sewer district will be approximately 3,100 in 1940. The plans provide for one outfall which will discharge into the West Branch of Fish creek about 550 feet below the mouth of the Mad river and about 250 feet above the mouth of Emmons Brook.

The plans have been carefully examined with respect to the sewerage system and sewage disposal works. In connection with the sewerage system the design has been carefully studied with reference to alignment, sizes, grades, capacities, facilities for cleaning and inspection and flushing and other features of a hydraulic or sanitary nature. In connection with means for sewage disposal it has been studied with reference to general method and efficiency of the sewage disposal plant as a whole, and of the capacities and practical operation of the individual structures, appurtenances and apparatus.

Sewers have been designed for all streets of the village and are indicated on the general plan of the sewerage system by solid and by broken lines, the former being the sewers which it is proposed to build at once while the latter are those which are to be omitted from construction at present. An examination of the plan shows that it is proposed to omit from construction sewers in Mexico, Mill, Dunbar, Florence, Mount Parnassus, Cropper, Preston, Cemetery, Taberg and other streets.

The sewers range in size from 8 inches to 15 inches in diameter and are evidently of sufficient size and capacity and are to be laid with slopes sufficiently steep to satisfactorily care for the maximum amount of sewage, which will ultimately be contributed to them. The engineer's report states that a portion of the Taberg street sewer is designed on a grade of 0.3 per cent. This is presumably a portion of the sewers across private property since the sewers in the streets have grades not less than 0.42 per cent. but the grades of the sewer between Taberg street and the disposal plant, which sewers are shown by dotted lines are not given in the plans. The engineer states, however, that these sewers will probably never be constructed because the territory is flooded at certain times.

Manholes are placed at every change of grade and alignment and the maximum spacing between manholes is about 400 feet. Ample facilities are evidently provided for inspection and cleaning of the sewers. Flush tanks are shown by the plans as placed at the upper ends of nearly all laterals. Where the grade of the lateral is steep, as in Hill street, a flush tank is not provided.

The general plan shows the sewers as crossing the different streams some eleven times, but a number of these are crossings of very small streams where no special provision will have to be made and the crossings at Mount Parnassus street, Church street, Railroad street, and others are apparently to be made on existing bridges. However, the crossings of Fish creek by the Cemetery street connection and by the Mexico street sewer and the crossing of Mad river by the main outfall are to be made by means of inverted siphons, provided with special manholes, one on each side of the creek. The siphons are to consist of lines of pipe of two different sizes so that a maximum velocity may be at all times obtained and one line may be used while the other is being cleaned. The siphon manholes are to be constructed of reinforced concrete and the two lines of pipe which are to be 6 inches and 8 inches in diameter, respectively, take the sewage from a trough in which a stop plank diverts the sewage into either of the two pipe lines. These pipes are to be provided with gate valves in order to facilitate, flushing, inspection and cleaning. The sewage passes from the siphon through a trough in the manhole on the opposite side of the creek and thence into the sewer.

The sewage will be conveyed to the disposal works entirely by gravity except in the case of a part of Mill street, and the western part of Liberty street. If these sewers are constructed in the future it is proposed to install a duplicate pumping equipment and pump the sewage to a manhole

further east on Liberty street from which the sewage will flow by gravity to the disposal works. The pumps are to consist of 4-inch centrifugal pumps directly connected to horizontal motors, to be automatically operated by floats. Details of this pumping plant which is not to be constructed at this time are not shown on the plans.

It is proposed to treat the sewage collected by this system in a sewage disposal plant located on a low flat area near the eastern corporation boundary line and lying between the Mad river, Fish creek and Emmon's brook.

These streams have a drainage area above this point of approximately 102.5 square miles according to the engineer's report. Fish creek which empties into Oneida lake is not used as a source of public water supply below Camden.

The site of the sewage disposal works is almost 750 feet from the nearest street, namely, Taberg street. The engineer's report states that this street will probably never be built up because the territory is flooded at certain times. The site is at a considerable distance from any built up section. The August high water elevation in Fish creek is given as 148.0 which is about 6.5 feet below the elevation of the top of the lowest structure, i. e. the settling tank. It is probable therefore that the operation of the plant will not be interfered with except during extreme high water conditions. The tops of the several manholes and of the different structures moreover, are shown as extending about 3 feet above the ground surface and the sewer lines are laid about 2 feet below the surface.

The report of the engineer states that the sewage will contain besides household sewage, wastes from two creameries and a small amount of chemicals from a knitting mill. The report also states that the volume of the wastes from the knitting mill is so small as to have little effect on the treatment of the sewage but that the creamery wastes will affect the treatment to some extent. A volume of sewage equal to 150 gallons per capita per day has been used in the design of the sewers.

Upon reaching the disposal plant the sewage enters a screening chamber, which is located in the same building as the pumping plant. The sewage will pass through an inclined screen composed of ⅜ by 1½ inch bars spaced 1½ inches apart. This building is roofed and ample provision is made for the removal of the screenings.

From the screening chamber the sewage passes into the distributing trough of the settling tank which is to be circular reinforced concrete tank of the Imhoff vertical flow type. The sewage flows through 12 3 x 6-inch ports from the distributing trough into the settling compartment where it flows downward under a baffle and passes into the collection trough through 24 6-inch pipe outlets. It is apparent that it will be necessary to use great care in setting the outer end of these outlet pipes at the same elevation because the sewage would tend to flow out through any which should be placed at a lower elevation thereby disturbing the uniformity of the flow and increasing the probability of the pipes clogging. Some of the elevations given on the plan of the settling tank are evidently slightly in error since they do not coincide with the scale and are not consistent. If the collection trough were built in accordance with the given elevation the bottom of the distributing trough will be at the same elevation as the outlet side of the collection trough which although it may be intended is not shown by the plans.

The settling compartment has a capacity sufficient to give a period of detention of the sewage in the tank of about 5 hours for the present population and a per capita water consumption of 100 gallons per day and of about 3.5 hours for the future population of 3,100. The sludge compartment has an available capacity of about 2,200 cubic feet below a plane about 1 foot beneath the slot. This capacity is sufficient to provide a period of detention of the sludge of about 6 months when the plant is serving a population of 2,170 and of about 4.5 months when the population shall be 3,100.

At the present time it is proposed to construct only the settling tanks

and sludge bed and chlorination plant but when in the future additional treatment works become necessary it is proposed to further treat the sewage in sprinkling filters and final settling tanks.

Therefore, when the future installation has been completed the sewage will flow from the Imhoff tank into the pump well, from which it will be pumped into the dosing tank of the sprinkling filters. This dosing tank will have a capacity, according to the engineer's report, of about 1,800 gallons, which will cause the sewage to be discharged onto the filter beds about once every five minutes when in the future the population is 3,100, if the per capita water consumption is about 100 gallons per day. The sprinkling filters will consist of two beds having an area of about 0.3 acre in all, which for the future population would give a rate of application of the sewage to the bed of about 1,070,000 gallons per acre per day.

The beds will consist of 7 feet of crushed stone and the effluent will be discharged into one of the two Imhoff tanks which will be used as a final settling tank.

At the present time, however, the effluent of the preliminary settling tank will be conveyed to the chlorination plant, where it will be sterilized by the application of chlorine gas, the flow of which is to be regulated by an apparatus to be installed for that purpose. The application chamber is provided with a sludge pipe to remove any solids which may be deposited. From the chlorination plant the sterilized effluent will be discharged by gravity into Fish creek. The proposed rate of application of the chlorine to the sewage is given as six parts per million.

The sludge from the sludge compartment of the settling tank will flow through a screen to consist of ½ inch round rods spaced 2½ inches on centers into the sludge pump well. A centrifugal pump to be operated by a 10 h. p. electrical motor will lift the sludge and discharge it onto the sludge bed. The sludge bed will have an area of 1,600 square feet or about 737 square feet per 1,000 population for the estimated future growth. The sludge bed is to consist of 12 inches of coarse sand, 6 inches of ¼-inch to 1½-inch screened gravel and 6 inches of 1½ to 3 inches cobble laid over 4-inch underdrains discharging into an 8-inch main collector which will discharge the drain water into the main pipe to the chlorination plant. An additional settling tank and sludge bed for future development are shown on the plans.

The preliminary and final settling tanks will apparently be of the same capacity in order that they may be used alternately as a preliminary tank.

There are two points regarding the design which it would seem should be discussed at this time, the one relating to sterilization of the tank effluent at present and the other regarding the construction of the outlet pipe which will carry the effluent into the main channel of the stream.

It is not believed that conditions at Camden and below the village necessitate the sterilization of the tank effluent at present and possibly for some time in the future and it is suggested that the permit provision regarding sterilization of the effluent provide that the sterilizing of the sewage shall be optional with the village for the present or until such time as such sterilization shall be required by the State Commissioner of Health.

It is believed also that the conveyance of the tank effluent to the point in the main channel of Fish creek will defer the necessity for constructing sprinkling filters or additional works for more complete treatment of the sewage and it is also suggested that the permit provision be included requiring that the effluent pipe shall be extended to the main channel of the river or at least into Fish creek one-quarter the width of the stream. It would be advisable to construct a drop manhole on the bank of the river in place of the bulkhead shown by the plans and to extend a cast-iron outfall pipe under the bed of the stream from the bottom of this drop manhole with the outlet end at a point in the main channel of the stream.

In view of the results of our examination of these plans and after careful consideration of the essential features of the design and of local and general requirements with respect to proper methods for the disposal of sewage from

the proposed system of sewers I beg to recommend that these plans be approved on condition:

1. That more complete detailed plans of the dosing tank and sprinkling filters be submitted to this Department for approval before these structures are installed.
2. That a rate of application of the sterilizing agent of not less than fifteen parts of chlorine per million parts of sewage effluent be used to sterilize the sewage when this is required by the State Commissioner of Health.
3. That the outlet pipe be extended into Fish creek at least one-fourth the width of the stream in such a manner that it shall be properly protected against damage from high water and ice and that the outlet end shall be submerged at low water stage.

Respectfully submitted,
THEODORE HORTON,
Chief Engineer

ALBANY, N. Y., *March* 23, 1915

PERMIT

Application having been duly made to the State Commissioner of Health, as provided by section 77 of chapter 49 of the Laws of 1909, the "Public Health Law," as amended by chapter 553 of the Laws of 1911, constituting chapter 45 of the Consolidated Laws, permission is hereby given to the Board of Trustees of the village of Camden to discharge effluent from the sewage disposal works to be constructed in connection with the proposed sewer system for the village into the waters of Fish creek at the point of discharge shown by the plans within the municipality of Camden in accordance with the plans accompanying the petition, under the following conditions:

1. That this permit shall be revocable at any time or subject to modification or change when in the judgment of the State Commissioner of Health such revocation, modification or change shall become necessary.
2. That the issuance of this permit shall not be deemed to affect in any way action by this Department on any future application that may be made for permission to discharge additional sewage or effluent into the waters of this State.
3. That both the sewer system and the sewage disposal works shown by plans approved this day shall be constructed in complete conformity with such plans or approved amendments thereof.
4. That only sanitary or domestic sewage, and no storm water or surface waters from streets, roofs or other areas shall be admitted to the proposed sewers.
5. That no sewage sludge from any part of the disposal works shall be discharged into Fish creek or any other watercourse or body of water.
6. That not less than 15 parts of chlorine per million parts of sewage effluent shall be at all times properly applied to the effluent from the settling tank, whenever sterilization of the effluent shall be required by the State Commissioner of Health.
7. That the effluent pipe, in accordance with plans satisfactory to this Department, shall be extended into Fish creek at least ¼ the width of the stream and in such a manner as to be protected against damage from high water and ice with the outlet end submerged at low water stage.
8. That whenever required by the State Commissioner of Health, satisfactory detailed plans for the sprinkling filters for more complete treatment of the sewage of the village, shown in general by the plans approved this day, shall be submitted for approval and upon approval of said plans, any or all portions of such additional works for more complete treatment of the sewage shall be constructed and put in operation at such time or times thereafter as said commissioner shall designate.

LINSLY R. WILLIAMS,
Deputy State Commissioner of Health

March 29, 1915

CANANDAIGUA (Cheshire School)

HERMANN M. BIGGS, M.D., *State Commissioner of Health:*

Amended plans for sewage disposal for the proposed school at Cheshire in the town of Canandaigua, Ontario county, were submitted to this Department for approval on November 11, 1915, by the architect, Mr. J. Mills Platt of Rochester.

Plans were previously submitted on August 11, 1915, and on September 29, 1915, but it was found upon examination of the plans that modifications in the design were necessary in order to protect the sanitary quality of the public water supply of the city of Canandaigua and to insure efficient operation of the disposal plant. The plans were, therefore, returned for modification.

The plans at present submitted consist of duplicate blue prints of 2 plans showing details of the proposed settling tank and a general plan of the proposed disposal plant. The settling tank shown in the design now submitted for approval is similar to the one previously submitted as regards baffles, manholes and material of construction and will have a total capacity of about 900 gallons. The central baffles should be omitted as should also the concrete wall which previously separated the main part of the tank from the siphon. The third baffle in front of the partition wall should be placed in front of the outlet. The lower outlet should be omitted and the upper outlet, marked "overflow" on the plans, should be provided with a bend similar to the inlet in order to give a submerged outlet.

The sewage is to flow through a 4-inch vitrified tile pipe sewer from the school building to the settling tank and after passing through the tank will flow through 4-inch field tile pipe to the diverting valve of the subsurface irrigation system. The subsurface irrigation system, which will be located about 100 feet from the school building, is to consist of two absorption areas. Each area is to contain 5 lines of 4-inch field tile 100 feet long laid about 4 feet apart center to center. The slope of the pipes of the distributing system is to be not less than ¼ inch to one foot.

A total of 1,000 feet of distributing tile pipes is, therefore, to be provided in the present design or about 6.7 ft. per person. It will be possible to divert the sewage into either half of the absorption field by means of the diverting valve. On the general plan submitted it appears that the proposed subsurface irrigation system will be located about 150 feet from the small brook passing in the rear of the schoolhouse and that the elevation of the surface of the ground rises between the field and the brook.

From our examination of these plans it appears that they have been modified in general accordance with the recommendations of the reports on the examination of the plans previously submitted. The 4-inch sewer from the school building to the settling tank should, however, be increased in size to 6 inches. Although the cost will be slightly greater than for a 4-inch sewer, 6-inch vitrified tile pipe should be used for this sewer in order to better prevent clogging. The 6-inch sewer should be laid on a grade of not less than 0.6 per cent.

A detailed statement of the nature of the subsoil has not been furnished by the architect as called for in the previous report. The letter received from the architect dated August 11, 1915, stated that the soil at the disposal plant site is loam. Inasmuch as this statement was indefinite and gave little or no indication as to the porosity of the soil, it was recommended in the report on the previous examination of the plans dated October 11, 1915, that "a detailed statement as to the nature of the soil and subsoil to a depth of 3 feet at the disposal site should be submitted" by the architect.

This requirement was apparently overlooked by him since no additional data as to the nature of the soil were submitted with the present plans. It is probable, however, that the soil, if loam, is heavy and compact and not well adapted to quickly absorb sewage or sewage effluent and that in the construction of the subsurface irrigation field it would not be safe to use less than 15 feet of distributing tile per pupil at the school.

I, therefore, beg to recommend that the plans for sewage disposal for the proposed school at Cheshire be approved on the following conditions:

1. That the subsurface irrigation system contain not less than 15 feet of distributing tile per pupil at the school.
2. That the size of the sewer from the school house to the settling tank be not less than 6 inches and that it be laid on a slope of not less than 0.6 per cent. The architect should also be advised to fence off the subsurface irrigation field to keep out both school children and live stock which may disturb the distribution system. I would also recommend that the architect carry out the suggestions made above in regard to the rearrangement of the baffles, omission of the division wall and rearrangement of the outlet.

Respectfully submitted,
THEODORE HORTON,
Chief Engineer

ALBANY, N. Y., *November* 22, 1915

The plans were approved on November 22, 1915, on the condition that the recommendations of this report be followed in the construction of the sewer and disposal plant.

CATSKILL

HERMANN M. BIGGS, M.D., *State Commissioner of Health:*

Plans for a proposed sewer extension in the village of Catskill, Greene county, were submitted to this Department for approval on August 25, 1915.

A number of complaints of the insanitary conditions caused by the discharge of sewage into a small stream tributary to Voosenkill or Ramshorn creek near High street in the village were made to the Department during the early part of this yar. The matter of abating these insanitary conditions was taken up with the village authorities as a result of which plans for an extension of the existing sewer from High street to a point near the railroad culvert under the West Shore R. R. were submitted to this Department for approval on May 26, 1915.

It is found from our examination of these plans that they were not in satisfactory conditions for approval and that insufficient data were submitted with them to permit of finally passing on the plans. They were, therefore, returned for modifications in the following respects:

1. That manholes be provided at the junction of the existing sewer with the proposed sewer and at all points of change of slope and alignment and that such manholes be shown on the plans.
2. That a general plan be submitted of the portion of the village to be served by the proposed sewer or that the location of the sewer be shown on the Catskill sheet of the U. S. Geological Survey.
3. That a covering or fill of not less than 3½ ft. over the sewer be provided and shown by the plans.
4. That a report be submitted with the plans, giving, in general, the following information:
   (a) The area and estimated future population to be served by the proposed sewer.
   (b) As to the exclusion of storm water from the sewer.
   (c) The nature and size of the stream into which the sewage is to be discharged and the nature of the district through which it flows.
   (d) The distance of the proposed point of discharge from the Voosenkill.
5. That the plans, when returned, be submitted in duplicate.

Our examination of plans now submitted show that they have been revised in general accordance with the above requirements. Manholes have been provided at all points of change of slope and alignment and at the junction

of the proposed sewer with the existing sewer. A cover of not less than 3½ feet over the sewer has been provided. The design of the sewer has, however, been changed somewhat. The lower 50 ft. of the sewer is to be 20 inches in diameter and is to be constructed with a slope of 2 per cent. The upper portion of the sewer is to be 12 inches in diameter and is to have a slope of 2.85 per cent.

According to the report of the village engineer, the sewer serves an area of about 12 acres and will take the storm water which now enters the High Street sewer of which this is an extension. It is stated, however, that most of the storm water of the section served by the proposed sewer will be discharged directly into the small stream tributary to the Voosenkill along which this sewer is to be constructed.

With respect to the discharge of sewage from the proposed sewer into a small stream several hundred feet from the Voosenkill it would appear that this may result in transferring the present nuisance to a point further down the stream and that it will be necessary in the future to extend this sewer to the Voosenkill a distance of about 345 feet.

The question of the continuous discharge of untreated sewage from the village of Catskill into the Hudson river and its tributaries should, in my opinion, be given consideration at this time. It has been the consistent policy of this Department to require, in connection with the approval of plans for the construction of new sewers, that consideration should be given to the question of future treatment of the sewage to be collected by such sewers especially where public water supplies are involved. This action has been considered necessary not only for the protection of the municipalities themselves, but for the protection of other municipalities which may be located on the stream or watercourses below the point of discharge of the sewage. The permits issued during the past few years in connection with the approval of plans for sewers or municipalities along the Hudson have contained the requirement that steps should be taken to treat the sewage before its discharge and as the results of such action many of the municipalities along the Hudson river have either constructed sewage disposal plants or are to construct such plants under plans approved by this Department. The discharge of untreated sewage from the village of Catskill affects not only the village itself, but other communities which are located on the river below, some of which derive their water supply from the Hudson. I am of the opinion, therefore, that the village should take steps at an early date to provide for at least a preliminary treatment of its sewage.

Inasmuch as no general sewer plans of the village have ever been submitted, a comprehensive plan covering all portions of the village should be submitted for approval in connection with plans for preliminary treatment of the sewage. The village law provides that such plans may include any existing sewers which may be found feasible or proper to incorporate or include in the system. Such action by the village would insure that future sewer construction would be carried out along comprehensive and permanent lines and would give more satisfactory results and be more economical in the long run than the procedure followed by the village in the past. After the approval of such comprehensive plans for sewerage and sewage disposal the village may construct the whole of said system or may temporarily omit any portions thereof until such portions may be necessary subject to the approval of the State Commissioner of Health as provided by the village law.

Inasmuch as there appears to be urgent need for the construction of the proposed sewer extension I would recommend that the plans for the proposed sewer be approved and a permit issued allowing the discharge of sewage from this sewer into a tributary of the Voosenkill without requiring the submission of plans for sewerage and the partial treatment of the sanitary sewage of the village before the construction of the proposed sewer. I would further recommend that the permit contain in addition to the usual revocation and modification clauses, the following conditions:

1. That on or before February 1, 1917, plans for a comprehensive sewer system covering all portions of the village be submitted for approval and

that these plans be accompanied by satisfactory detailed plans for intercepting and outfall sewers to convey the entire sanitary sewage of the village of Catskill to a suitable site for sewage disposal together with detailed plans for the preliminary treatment of such sewage.

2. That the proposed sewer should be extended to the Voosenkill whenever required.

Respectfully submitted,

THEODORE HORTON,
Chief Engineer

ALBANY, N. Y., *September* 22, 1915

PERMIT

Application having been duly made to the State Commissioner of Health, as provided by section 77 of chapter 49 of the Laws of 1909, the "Public Health Law," as amended by chapter 553 of the Laws of 1911, constituting chapter 45 of the Consolidated Laws, permission is hereby given to the board of trustees of the village of Catskill to discharge sewage from the proposed sewer extension from High street to the railroad culvert under the West Shore tracks into the waters of a tributary of the Voosenkill at the point of discharge shown by the plans, within the municipality of Catskill, in accordance with the plans accompanying the petition, under the following conditions:

1. That this permit shall be revocable at any time or subject to modification or change when in the judgment of the State Commissioner of Health such revocation, modification or change shall become necessary.
2. That the issuance of this permit shall not be deemed to affect in any way action by this Department on any future application that may be made for permission to discharge additional sewage or effluent into the waters of this State.
3. That the proposed sewer shall be extended to the Voosenkill whenever required by the State Commissioner of Health.
4. That on or before February 1, 1917, satisfactory detailed plans for intercepting and outfall sewers to convey the entire sanitary sewage of the village of Catskill to a suitable site or sites for sewage disposal works, together with detailed plans for preliminary treatment by sedimentation of the entire sanitary sewage of the village shall be submitted to this Department for approval; and upon approval of said plans any or all portions of the intercepting and outfall sewers and of the sewage disposal works shall thereafter be constructed whenever required by the State Commissioner of Health.
5. That the plans for the interception and disposal of the sewage of the village shall be accompanied by detailed plans for a comprehensive sewer system covering all portions of the village.

LINSLY R. WILLIAMS,
Deputy Commissioner of Health.

September 24, 1915

CATTARAUGUS COUNTY TUBERCULOSIS HOSPITAL

HERMANN M. BIGGS, M.D., *State Commissioner of Health:*

Plans for sewage disposal for the Cattaraugus County Tuberculosis Hospital were submitted to this Department for approval on September 28, 1915.

Plans for sewage disposal for the institution were first submitted in person by one of the architects of the hospital on September 4, 1915. The plans were at that time given a preliminary examination and the architect was advised to modify them in a number of respects.

The plans now submitted show that it is proposed to care for the sewage from the institution in a sewage disposal plant consisting of a settling tank, dosing chamber, subsurface irrigation system and auxiliary sludge drying bed for the disposal of sludge. It appears from notes on the plans that the present population at the hospital is about 32 and that the disposal plant has been designed to care for a population of 50. No statement is made, however, as to the probable maximum future population to be cared for at the institution nor as to the nature of the soil at the site of the disposal plant.

The settling tank is to be located about 450 feet from the hospital building and about 600 feet from the remainder of the disposal plant. The tank which is to be covered, is to be provided with a manhole to facilitate inspection and cleaning. It is to be 16 feet by 5 feet in plan and 6 feet deep inside dimensions with a depth below the flow line of about 5 feet giving a capacity of 3,000 gallons. The tank will, therefore, have sufficient capacity to give an average detention period of about 14 hours when serving a population of 50, assuming a rate of sewage contribution of 100 gallons per capita per day.

The effluent from the settling tank is to flow over a weir into an adjacent dosing chamber equipped with a 5-inch automatic discharge siphon by means of which the sewage is to discharge through a 5-inch pipe having a slope of about 11 per cent. to a diverting manhole near the subsurface irrigation system. This diverting manhole or gate chamber is to be 4 feet by 2 feet in plan and about 2½ feet deep. It is to be provided with an overflow leading to the sludge bed and four 4-inch outlet pipes leading to the four sections of the disposal field. These pipes are to leave the tanks in pairs and a stop plank is provided for each pair of outlets.

Each section of the subsurface irrigation system is to contain 800 feet of distributing tile composed of 400 feet of 4-inch tile and 400 feet of 3-inch tile laid with ¼-inch open joints covered with tar paper. The lines of tile which are to be spaced 3½ feet center to center are to be laid in trenches at a depth of 12-inches below the ground and are to be surrounded with cinders. The line of tile in each field is to be continuous and is to zig-zag back and forth with a distance of about 100 feet between each reversed turn. Although the slope of each 100 feet of sections of pipe is to be about ⅓ per cent. the slope of the hydraulic gradient of the whole line is to be from ½ per cent. to 1 per cent.

The total length of the distributing tile is to be 3200 feet giving 62 feet of tile per person served. The system as laid out would cover an area of .3 of an acre giving a rate of operation of about 16,000 gallons per acre per day. If the soil is of a loose, porous nature, the proposed rate of operation will not be excessive.

It is planned to discharge the sludge from the settling tank and dosing chamber to the sludge bed near the disposal field through the effluent pipe connecting the dosing chamber with the diverting manhole at the head of the subsurface irrigation system. The upper end of the sludge pipe is to be provided with a shear gate and the effluent pipe into which it discharges is to be divided into two branches immediately above the diverting manhole. These branches are to be provided with valves and one branch is shown leading to the diverting manhole and the other to the sludge bed. The sludge bed is to be 20 feet in plan and is to be filled to a depth of 18 inches with cinders. It is not to be provided with underdrains.

In conclusion I would state that it is found from the examination of the plans that although they have in general been designed to meet the local requirements for sewage disposal for the institution, additional data should be submitted and certain modifications should be made in the plans before they can be finally passed upon.

A statement should be submitted as to the nature of the soil at the disposal plant and as to the probable maximum future population to be cared for at the institution. The capacity of two sections of the subsurface irrigation system is found to be less than the capacity of the dosing chamber. If the plant were constructed as planned there would be a tendency to surcharge the irrigation system or cause an overflow at the diverting manhole. If the same number of feet of tiling is to be used in each system the capacity

of the dosing chamber should be reduced to about 700 gallons. This could readily be done by decreasing the dimensions of the dosing chamber.

It is also found that the capacity of the effluent pipe from the dosing chamber to the diverting manhole, which pipe will have a hydraulic gradient of about 11 per cent. is considerably greater than the capacity of two of the 4-inch pipes leading from the diverting manhole to the subsurface irrigation system. This would result in causing the effluent to back up in an overflow from the diverting manhole. It would be better, if possible, to locate the tank near the diverting manhole at the disposal field and to place it at such an elevation that the flow line of the dosing tank will not be much higher than the elevation of the top of the diverting manhole.

The outlet pipes leading from the diverting manhole to the different sections of the subsurface irrigation system should also be increased in size to 5 inches and owing to the length of the pipe in each system each of the four lines from the diverting manhole should be provided with a diverting manhole having two branches leading to two different subdivisions of the subsurface irrigation system. This would provide for 8 sections in this system instead of 4 and reduce the length of each distributing line from 800 to 400 feet. The elbow at each turn on the distributing line should consist of vitrified tile pipe and the joint of the first length of tile pipe on each side of the elbow should be of cement. The entire length of each system below the main distributor should be 4 inches instead of having a portion of the line 4 inches and the remainder 3 inches as planned. The overflow pipe leading from the diverting manhole to the sludge bed should either be omitted or provided with a valve so that it can be used only in case of emergency.

The sludge from the settling tank should be discharged directly to the sludge bed through an independent line of pipe and not through the effluent pipe as proposed. If the location of the tank be changed to a point near the subsurface irrigation system the sludge from the tank could be discharged to a sludge bed through a comparatively short length of tile.

In view of the above I would recommend that the plans be returned to the architects for additional data and for modifications in the following respects:

1. A statement as to the nature of the soil at the site of the subsurface irrigation system and the probable maximum future population to be served by the plant should be submitted.
2. The capacity of the dosing tank should be reduced to about 700 gallons.
3. The settling tank should, if possible, be placed nearer the subsurface irrigation system and an independent sludge pipe from the settling tank to the sludge bed should be provided.
4. The elevation of the flow line of the dosing tank and the slope of the effluent pipe should be so adjusted that the effluent from the dosing tank will not be discharged into the subsurface irrigation system faster than it can be disposed of.
5. The main distributors leading from the diverting manhole to the subsurface irrigation system should be increased in size to 5 inches in diameter and should be provided with a diverting manhole with two branches so as to subdivide each section into two units.
6. The distributing pipe of each field should be 4 inches in diameter for its entire length.
7. The elbow at each bend of the distributing system should be vitrified tiling and the adjacent joints cemented.
8. The overflow from the diverting manhole to the sludge bed should either be omitted or provided with a valve.

Respectfully submitted,

THEODORE HORTON,
Chief Engineer

ALBANY, N. Y., *October* 5, 1915

These plans were returned for revision in accordance with the above recommendations on October 5, 1915.

HERMANN M. BIGGS, M.D., *State Commissioner of Health:*

Revised plans for sewage disposal for the Cattaraugus County Tuberculosis Hospital, were submitted to this Department for approval on October 11, 1915.

These plans were first submitted for approval on September 28, 1915. A careful examination of them showed that although they had in general been designed to meet the local requirements for sewage disposal for the institution there were certain modifications which should be made in them before their final acceptance. The plans were accordingly returned to the architects for the institution together with a copy of the report on the examination of the plans, dated October 5, 1915, and the architects were advised that additional data should be submitted and that the plans should be modified in accordance with the recommendation embodied in this report, namely:

1. A statement as to the nature of the soil at the site of the subsurface irrigation system and the probable maximum future population to be served by the plant should be submitted.
2. The capacity of the dosing tank should be reduced to about 700 gallons.
3. The settling tank should, if possible, be placed nearer the subsurface irrigation system and an independent sludge pipe from the settling tank to the sludge bed should be provided.
4. The elevation of the flow line of the dosing tank and the slope of the effluent pipe should be so adjusted that the effluent from the dosing tank will not be discharged into the subsurface irrigation system faster than it can be disposed of.
5. The main distributors leading from the diverting manhole to the subsurface irrigation system should be increased in size to 5 inches in diameter and should be provided with a diverting manhole with two branches so as to subdivide each section into two units.
6. The distributing pipe of each field should be 4 inches in diameter for its entire length.
7. The elbow at each bend of the distributing system should be vitrified tiling and the adjacent joints cemented.
8. The overflow from the diverting manhole to the sludge bed should either be omitted or provided with a valve.

The letter submitted with the present plans states that there will never be more than 50 people in the building for which the disposal plant has been designed and that any additional buildings will be outside in the form of shacks for which other means of sewage disposal will be provided. It is also stated that the soil is of a clay character containing boulders and some stratified loose rock. This is the first statement with reference to the nature of the soil that has been submitted.

It would appear that soil of this nature is not well suited for the disposal of sewage by subsurface irrigation and although the distributing tiles as noted in the previous report are to be laid in trenches filled with cinders which should facilitate the distribution of the settling tank effluent throughout the system, it may become necessary either to extend the subsurface irrigation system or to supplement it with broad irrigation or some other means of supplementary treatment if it is found that the soil is of too impervious a nature to properly absorb the effluent.

The capacity of the dosing tank has been decreased to 750 gallons and the settling tank and dosing tank have been placed near the subsurface irrigation system as recommended. An independent sludge pipe leading from the settling tank and dosing tank to the sludge drying bed has also been provided.

The sewer leading from the house to the disposal plant is 5 inches in diameter and about 1,000 feet long. No manholes are shown along the line of this sewer. It is important that manholes should be placed at all points of change of slope and alignment and at intermediate points not more than 300 feet apart and that the sewer should be laid with straight alignment between adjacent manholes in order to facilitate cleaning and inspection inasmuch as the sewer is to carry raw sewage and not settled sewage as originally planned.

According to a note on the plans the elevation of the top of the main distributing manhole above the irrigation system is to be level with the bottom of the dosing chamber and the main distributors leading from the diverting manhole to the subsurface irrigation system has been increased to 5 inches in diameter. It is probable, therefore, that there will be no overflowing of sewage at the main distributing manhole. Each of the 4 lines leading from the main manhole is to be provided with a secondary diverting manhole having two outlets, each of which is to feed one section of the subsurface irrigation system. The distributing pipe of each of the proposed sections of the irrigation fields is to be 4 inches in diameter for its entire length and the elbow at each bend of the distributing system is to be of vitrified tile with cemented joints. The overflow from the diverting manhole to the sludge bed is also to be omitted as recommended.

It appears, therefore, that the plans have been modified in accordance with the requirements of this Department and that the proposed sewage disposal system if properly constructed should satisfactorily care for the population for which it has been designed, provided the soil is not too heavy. As noted above it may become necessary, however, to extend the subsurface irrigation system or supplement it with broad irrigation, if the soil is found to be too heavy to properly absorb the sewage.

I would, therefore, recommend that the plans be approved on the following conditions:

1. That manholes be placed at all changes of slope and alignment and at intermediate points not more than 300 feet apart.
2. That the sewer be laid with straight alignment between adjacent manholes.
3. That the subsurface irrigation system be extended or some other means of final treatment of the sewage be provided whenever required.

Respectfully submitted,

THEODORE HORTON,
Chief Engineer

ALBANY, N. Y., *November* 3, 1915

The plans for sewage disposal for the Cattaraugus County Tuberculosis Hospital were approved on November 3, 1915, on the following conditions:

1. That manholes be placed at all changes of slope and alignment and at intermediate points not more than 300 feet apart.
2. That the sewer be laid with straight alignment between adjacent manholes.
3. That the subsurface irrigation system be extended or some other means of final treatment of the sewage be provided whenever required.

CLAY (Sewer District No. 1)

HERMANN M. BIGGS, M.D., *State Commissioner of Health*:

Plans for sewers in Sewer District No. 1 of the town of Clay, Onondaga county, were submitted to this Department for approval by the Sewer Commissioner on November 26, 1915. A duplicate copy of the plans was received on November 27, 1915.

The records of the Department show that permits have been issued to the J. W. Weller, and to W. A. Moulton, sauerkraut factories located at Clay, allowing the discharge of effluents from settling tanks to be used to treat the waste water and washings from these factories into the waters of Shaver brook. Following the issuance of these permits it was learned from Mr. Moulton that the residents of Clay desired to assess the cost of this sewer on the property owners along the street in which the sewer was to be laid and thus make it possible to provide sewerage facilities for the private residences as well as the factories.

On the advice of this Department a sewer district was established and a sewer commission appointed. The sewer commissioners, after the formation

of the sewer district, desired that an inspection be made by a representative of this Department with a view of recommending what changes, if any, should be made in the plans for sewerage contemplated by them.

This inspection which was made on November 5, 1915, by Mr. H. B. Cleveland, principal assistant engineer, showed that the stream into which the sewage effluent would be discharged is very small, having a limited drainage area. It rises about one-fourth mile south of the sewer district at the Clay Station and discharges into Oneida river, a tributary of the Oswego river at a point about two miles northwest of Clay. Although the flow of the stream is augmented by springs, the flow would not be sufficient to properly dilute even settling tank effluent if any considerable volume of sewage would be collected by the proposed sewer in the future. It appeared, however, that for the present settling tank effluent may safely be discharged at a point 500 feet from the highway which crosses the creek.

It was explained to the sewer commissioners that although the plans submitted should show general plans at least for sedimentation of sewage and the discharge of effluent at a point 500 feet from the highway, the Commissioner of Health would probably approve the temporary discharge of effluent from the settling tanks at the sauerkraut factories and the effluent from the settling tanks at two or three private residences which would be admitted to the sewer when constructed if such effluents were carried to a point 500 feet below the highway on the following conditions:

1. That the settling tank be constructed under plans approved by this Department and put in operation before any sewage not first treated be discharged into the sewer.
2. That additional or supplementary treatment of the sewage shall be provided whenever required by this Department.

The plans now submitted show a proposed sewer extending from the settling tank at the W. A. Moulton kraut factory to a point 500 feet below the highway, a distance of some 1,550 feet. The upper portion of this sewer from the settling tank at the factory referred to is to be 8 inches in diameter and is shown with a slope of about 2 per cent. from a point near the settling tank to manhole No. 1. From manhole No. 1 to the point of discharge the sewer is to be 10 inches in diameter and is designed with a slope of from 1 per cent. to 95 per cent. Manholes are to be provided at all points of change of slopes and alignments. No settling tank is shown by the plans as recommended by our Engineer.

The slopes of the proposed sewer as shown, except between manholes Nos. 3 and 4 should provide self-cleansing velocities in the sewer under ordinary conditions. An 8-inch sewer should have a slope of not less than 35 per cent. and it appears that there is sufficient fall between the settling tank and manhole No. 1 to secure this slope. The slope of a 10-inch sewer should not be less than 25 per cent. and this could be secured by decreasing the slope between manhole No. 3 and No. 4 and increasing the slope between manholes No. 1 and No. 3 as well as the slope of the 500 foot outlet sewer. A settling tank should also be provided near the lower end of the sewer.

From our careful examination of plans it appears that the proposed sewer has been designed in general accordance with our recommendations. The slope of the sewer should, however, be modified as indicated above and general plans for a settling tank to treat the sewage from the sewer should be submitted for approval before any sewage not already treated in settling tanks is admitted to the proposed sewer.

I would, therefore, recommend that the plans be approved and a permit be issued allowing the discharge of effluent from the existing settling tanks into Shaver creek at a point 500 feet below the highway on the following conditions:

1. That the 8-inch sewer be constructed with a slope of not less than .35 per cent.
2. That the 10-inch sewer be constructed with a slope of not less than .25 per cent.

3. That satisfactory plans for a settling tank to treat the sewage to be collected by the sewer be submitted to this Department for approval and such settling tank constructed and put in operation before any sewage not already treated in existing settling tanks be admitted to the proposed sewer.

4. That additional or supplementary treatment of the sewage of the sewer district be provided whenever required by this Department.

Respectfully submitted,
THEODORE HORTON,
Chief Engineer

ALBANY, N. Y., *November* 29, 1915

The plans were approved and a permit issued on the above conditions on December 2, 1915.

COHOES

HERMANN M. BIGGS, M.D., *State Commissioner of Health:*

Plans for a proposed sewer extension in the city of Cohoes, Albany county, were submitted for approval by the Common Council on August 18, 1915. A duplicate copy of the plans together with an application for the approval of the same, signed by the Commissioner of Public Works, was received on September 14, 1915.

The city of Cohoes is located at the mouth of the Mohawk river opposite Troy and about 7 miles above Albany. It is provided with a filtered water supply taken from the Mohawk river. The records of the Department show that the city is also provided with a comprehensive sewer system covering the greater portion of the city and discharging into the Mohawk river at a number of points. This system which has been constructed on the combined plan appears to have been built prior to 1903 and one outlet was constructed as early as 1868. According to a statment of the Health Officer of the city who presented the plans, no sewers have been constructed since 1903.

The plans now submitted show that it is proposed to construct a sewer in Niver street extending southerly in this street from Island avenue for a distance of about 360 feet, thence easterly through private property to the Mohawk river, a distance of about 600 feet. It is to discharge into the west branch of the Mohawk river at a distance of about 30 feet from shore. The point of discharge is opposite the southerly end of Van Schaick Island.

The proposed sewer is to be 8 inches in diameter and is to have slopes of 1.1 and 1.6 per cent. A manhole is to be located at the upper end of the sewer and at each point of change of slope and alignment so that ample facilities for inspection and cleaning will be provided for.

According to the letter from the mayor of the city submitted with the plans, this sewer will serve six residents at present and at no time could it be used by more than ten houses. It appears, therefore, that if properly constructed the proposed sewer should satisfactorily meet the future needs of the section to be served by it.

In view of the above and since there seems to be urgent needs for the construction of the proposed sewer, I would recommend that the plans be approved and a permit be issued allowing the discharge of sewage to be collected by it into the Mohawk river. The city should be advised, however, that steps should be taken, as has been done in other municipalities on the Mohawk and Hudson rivers near the city of Cohoes, to have a study of the sewerage conditions of the city made with a view of preparing plans for the most feasible and appropriate means of intercepting and disposing of the entire sanitary sewage of the city and I am of the opinion that until such plans are prepared and submitted to this Department for approval, plans for sewer extensions in the city should not be approved.

Respectfully submitted,
THEODORE HORTON,
ALBANY, N. Y., *September* 25, 1915 *Chief Engineer*

PERMIT

Application having been duly made to the State Commissioner of Health, as provided by section 77 of chapter 49 of the Laws of 1909, the "Public Health Law," as amended by chapter 553 of the Laws of 1911, constituting chapter 45 of the Consolidated Laws, permission is hereby given to Common Council of the city of Cohoes to discharge sewage from the proposed sewer in Niver street into the waters of Mohawk river opposite the southern part of Van Schaick Island within the municipality of Cohoes in accordance with the plans accompanying the petition, under the following conditions:

1. That this permit shall be revocable at any time or subject to modification or change when in the judgment of the State Commissioner of Health such revocation, modification or change shall become necessary.
2. That the issuance of this permit shall not be deemed to affect in any way action by this Department on any future application that may be made for permission to discharge additional sewage or effluent into the waters of this State.

LINSLY R. WILLIAMS,
Deputy State Commissioner of Health

September 27, 1915

DUNKIRK

HERMANN M. BIGGS, M.D., *State Commissioner of Health:*

Plans for the interception and disposal of sewage of the city of Dunkirk, Chautauqua county, were submitted to this Department for approval by the common council on March 31, 1915.

The records of the Department show that an inspection made by the consulting engineer of this Department in 1905 brought out the urgent need for sewerage facilities in the first and fourth wards of Dunkirk. Following this inspection permission was granted to the city to construct sewers in these portions of the city. The evident necessity for intercepting the sewage was pointed out at the time of the first inspection and was again brought to the attention of the city authorities in the report of the inspection of the sanitary conditions of the city made by this Department in 1908. On April 17, 1914, plans for sewer extensions in the city were approved and the permit issued in connection with the approval of these plans contains the provision that the city should submit for approval plans for the interception and treatment of the sewage and a general plan showing the boundary within which it might be desired by the city to continue the construction of sewers on the combined plan, outside of which boundary future sewer extensions shall be on the separate plan.

The plans now submitted were prepared by Hering & Gregory, consulting engineers, New York city, and comprise blue prints in duplicate of the following plans.

1. Three sheets showing plans, profiles, grades and sections of the proposed intercepting sewer.
2. Four sheets showing plans and details of pumping station and sewage disposal works.
3. General plans showing the boundary lines outside of which future sewer extensions shall be constructed on the separate plan.

Alternate plans for the intercepting sewer prepared by Mr. W. H. Shelton, city engineer of Dunkirk, were also submitted and comprise the following:

1. Two sheets of alternate plan "A" showing location and profile of proposed intercepting sewer.
2. Three sheets of alternate plan "B" showing plan, profile and cross section of intercepting sewer and sea wall.

The city of Dunkirk is situated on the west central boundary of Chautauqua county on the shore of Lake Erie. It is provided with an unfiltered water supply taken from Lake Erie. The water is treated with chlorine gas

With respect to the alternate plans for the interception of the sewage of the city, plan A providing for a sewer located in cutback from the water's edge should satisfactorily meet the local requirements provided the sewer is properly constructed at a sufficient distance from the lake to be beyond the influence of the erosion action of the waves. Plan B, providing for a sewer infill under water, does not appear to be satisfactorily protected from the action of ice and waves. The upper portion of the sewer if laid infill on the bottom of the lake would also be liable to settle, causing leaky joints and even if no settlement should take place it would be difficult and expensive to make the joints water-tight.

I would, therefore, recommend the approval of the complete plans for the interception and disposal of the sewage of the city prepared by the consulting engineers and of alternate plan A for the intercepting sewer, but would recommend withholding the approval of plan B. I would further recommend that the permit issued in connection with the plans should contain in addition to the usual revocation and modification clauses the following conditions:

1. That before the construction of the proposed sewer and sewage disposal works is commenced satisfactory specifications and detailed plans of all works shall be submitted for approval and that these detailed plans shall include the following:
   (a) Detailed plans of regulators.
   (b) Detailed plans showing the method of applying the chlorine gas to the effluent from the settling tanks and the point of application.
   (c) Detailed plans of all other structures.
2. The chlorine gas shall be applied uniformly to the effluent from the settling tanks in the proportion of not less than 5 parts of chlorine to one million parts of effluent before its discharge into Lake Erie and that this proportion shall be increased when required by the State Commissioner of Health.
3. That the outlet pipe from the disposal works shall be extended farther into the lake when required.

Respectfully submitted,

THEODORE HORTON,
Chief Engineer

ALBANY, N. Y., *April 15, 1915*

PERMIT

Application having been duly made to the State Commissioner of Health, as provided by section 77 of chapter 49 of the Laws of 1909, the "Public Health Law," as amended by chapter 553 of the Laws of 1911, constituting chapter 45 of the Consolidated Laws, permission is hereby given to the Common Council of the city of Dunkirk to discharge effluent from the proposed sewage disposal works for the city into the waters of Lake Erie at the point of discharge shown by plan within the municipality of Dunkirk in accordance with the plans accompanying the petition, under the following conditions:

1. That this permit shall be revocable at any time or subject to modification or change, when in the judgment of the State Commissioner of Health such revocation, modification or change shall become necessary.
2. That the issuance of this permit shall not be deemed to affect in any way action by this Department on any future application that may be made for permission to discharge additional sewage or effluent into the waters of this State.
3. That both the intercepting sewers and sewage disposal works shown by plans approved this day shall be fully constructed in complete conformity with such plans or approved amendments thereof.
4. That no sewage sludge from any part of the disposal works shall be discharged into Lake Erie or into any other watercourse or body of water.

5. That before the construction of the proposed intercepting sewers and sewage disposal works is commenced, satisfactory specifications and detailed plans of all works shall be submitted for approval; and that these detailed plans shall include the following:

(a) Detail plans of regulators.

(b) Detail plans showing point of application and the method of applying the chlorine gas to the effluent from the settling tanks.

(c) Detail plans of all other structures.

6. That chlorine gas shall at all times be uniformly applied to the effluent from the settling tanks in the proportion of not less than five parts of chlorine to one million parts of effluent before it is discharged into Lake Erie; and that that this proportion shall be increased whenever required by the State Commissioner of Health.

7. That the outlet pipe from the sewage disposal works shall be extended farther into the lake when required by the State Commissioner of Health in accordance with plans satisfactory to the said Commissioner.

LINSLY R. WILLIAMS,
Deputy State Commissioner of Health

April 28, 1915

EASTCHESTER (Sewer District)

HERMANN M. BIGGS, M.D., *State Commissioner of Health:*

Plans for sewer extensions for the Sewer District in the town of Eastchester, Westchester county, were submitted to this Department for approval by the Sewer Commissioners on September 1, 9 and 13, 1915.

Plans for a proposed sewer connection of an existing sewer in New Rochelle avenue, town of Eastchester with a sewer in Hutchinson boulevard in the city of Mt. Vernon were received on September 1 and 9, 1915, and a formal application for the approval of these plans was received on September 9. Plans for extensions in Waverly place, Rose avenue and other streets were received on September 13, 1915, and a formal application for the approval of these plans was received on September 16, 1915.

The records of this Department show that plans for a sewerage system for the Sewer District in the town of Eastchester were approved on November 27, 1912, and extensions in Alandale Park and California Park were approved on December 12, 1913. In the report upon the examination of the first mentioned plans it was pointed out that the ultimate method to be used to dispose of the sewage from the Paulding Manor District had not been determined and that one of two methods was proposed; either to discharge the sewage into the sewers of the city of Mt. Vernon or to pump the sewage into one outlet sewer passing through the village of Bronxville and discharging it into the Bronx valley trunk sewer.

It is proposed in the plans at present submitted to this Department for approval to build a 12-inch sewer to connect an existing sewer in New Rochelle avenue in the town of Eastchester with a 12-inch sewer in Hutchinson boulevard in the city of Mt. Vernon. This latter sewer, it is stated in a letter from the designing engineer, is the property of the Chester Heights Realty Co., and is connected with the sewer system of the village of Pelham at Fifth street and the sewage, therefore, will pass through the sewage disposal works of the village of Pelham. In the report on the examination of plans for a sanitary sewer system in the sewer district comprising the unincorporated portion of the town of Pelham, the sewage from which passes through the sewage disposal plant of the town of Pelham, it is stated that the disposal plant is designed for a total population of 8,000 whereas the population tributary to the disposal plant at that time (1913), from the town and from the village, was only 3,000, and it would, therefore, appear that the discharge through the disposal plant of the additional sewage contributed from this district of the town of Eastchester would not overtax the capacity of the plant at the present time.

The letter of the designing engineer also states that permission to make the connection has been obtained from the Chester Heights Realty Co. It is stated that the city of Mt. Vernon has an agreement with the village of Pelham to construct a 20-inch sewer through Altona Drive, which will apparently take the Hutchinson boulevard sewage and discharge it into the Mt. Vernon sewer system when it will pass through the disposal plant of the city of Mt. Vernon.

The proposed sewer is to be 12 inches in diameter and is to be laid on a slope of 0.2 per cent. which should be sufficient to provide a self-cleansing velocity of the sewage in the sewer and prevent clogging. Manholes are to be located at every change of slope and alignment of the sewer, the maximum spacing between manholes being about 435 feet.

Plans are also submitted by the Sewer Commissioners and approval is requested for sewers in Rose avenue, Waverly place, New street and other streets, which sewers it is stated have already been constructed. A comparison of these plans with the general plan of the sewerage system for Eastchester approved by this Department on November 27, 1912, shows that sewers are indicated in many of the streets shown on the plans at present submitted. A 10-inch sewer has been constructed in Rose avenue discharging both into a 10-inch sewer at Ridge street, which is shown on the general plan and into some sewer at or near the town boundary, which is not shown on the general plan but which is apparently in the village of Tuckahoe. A sewer has also been constructed in New street which extends from Waverly place to Midland avenue. A 10-inch sewer is shown practically in this same location on the general plan already approved. The sewer constructed is a 10-inch sewer but is apparently not constructed on the exact location indicated on the general plan.

A 6-inch sewer has been constructed in the lane in place of the 10-inch sewer shown on the general plan. On the general plan it appears that the sewage from a considerable area was to be discharged through this 10-inch sewer in the lane and it would therefore appear important that its size should not be decreased if the original plans are to be adhered to.

A 10-inch sewer has also been constructed in Waverly place and White Plains road. An 8-inch sewer is shown in this part of these streets on the general plan. A plan of all the sewers which have been constructed is not included on the plan now submitted. It appears, however, that the sewers are laid on slopes sufficiently steep to provide self-cleansing velocities and manholes are placed at every change of slope and apparently at every change of alignment.

In view of our examination of these plans submitted for approval I beg to recommend that both sets be approved on the following conditions:

1. That the sewage from the Paulding Manor section of the sewerage system of the town of Eastchester before its discharge into any watercourse of the State receive proper treatment either in the disposal plant of the town of Pelham, of the city of Mt. Vernon or in a disposal plant to be constructed for its treatment by the sewer district of Eastchester.

2. That the 6-inch sewer in the lane be replaced by a 10-inch sewer as shown on the general plan approved in 1912 previous to or at the same time that the sewers contributory to this sewer are built in accordance with the original approved plans.

Respectfully submitted,

THEODORE HORTON,
Chief Engineer

ALBANY, N. Y., *October* 25, 1915

PERMIT

Application having been duly made to the State Commissioner of Health as provided by section 77 of chapter 49 of the Laws of 1909, the "Public Health Law," as amended by chapter 553 of the Laws of 1911, constituting chapter 45 of the Consolidated Laws, permission is hereby given to the Board

of Sewer Commissioners of the Sewer District, town of Eastchester to discharge sewage from the proposed sewer extension between New Rochelle avenue in the town of Eastchester and Hutchinson boulevard in the city of Mt. Vernon into the waters of Hutchinson river through the outlet of the Pelham sewage disposal works within the municipality of Pelham Manor in accordance with the plans accompanying the petition, under the following conditions:

1. That this permit shall be revocable at any time or subject to modification or change when in the judgment of the State Commissioner of Health such revocation, modification or change shall become necessary.
2. That the issuance of this permit shall not be deemed to affect in any way action by this Department on any future application that may be made for permission to discharge additional sewage or effluent into the waters of this State.
3. That only sanitary or domestic sewage and no storm water or surface water from streets, roofs or other areas shall be admitted to the proposed sewer.
4. That all the sewage to be collected by the proposed sewer shall be passed through the sewage disposal works of the town of Pelham before its discharge into the Hutchinson river; and if at any time, owing to the lack of capacity of the Pelham sewage disposal works, or owing to a change of the route of flow of the sewage to be collected by the proposed sewer such sewage may not be passed through the disposal works of the town of Pelham it shall be treated in the sewage disposal works of the city of Mt. Vernon, or separate provisions shall be made for the treatment of the sewage from the proposed sewer in disposal works which shall be constructed in accordance with plans satisfactory to this Department.

LINSLY R. WILLIAMS,
Deputy State Commissioner of Health

November 3, 1915

EAST SYRACUSE

HERMANN M. BIGGS, M.D., *State Commissioner of Health:*

Amended plans for sewage disposal for the village of East Syracuse, Onondaga county, were submitted to this Department for approval by the Board of Sewer Commissioners of the village on May 29, 1915.

The records of the Department show that, on December 21, 1900, original plans for sewerage and sewage disposal for the village were approved. These plans provided for a separate sewer system and for a pumping station and chemical precipitation sewage disposal plant to be located near the intersection of Second and Henry streets near the developed section of the village. The effluent from this plant was to be discharged by gravity flow through some 5600 feet of 15-inch sewer into Butternut creek, a tributary to Oneida Lake.

On November 11, 1904, amended plans for sewage disposal, providing for remodeling the pumping station, for changing the location of the disposal plant site to a point about 1½ miles east of the original site and for substituting septic tank and sand filtration treatment for chemical precipitation, were approved. Although the proposed plant was more isolated than the plant originally planned, it required pumping of the sewage of the village through about 8000 feet of force main against a hydrostatic head of 45 feet.

The system of sewerage and sewage disposal provided for by the above plan was completed and put in operation in 1906. It was found, however, that, owing to the excessive infiltration of ground water into the very deep sewers of the eastern sections of the village and the high head against which it was necessary to pump the sewage, the pumping equipment, which had not been installed in duplicate, was not adequate to handle the amount of sewage and ground water tributary to it and the force main was tapped and the sewage discharged directly into Butternut creek against a head of

some 15 feet. Even under these conditions, it is found that the pumping charges were excessive and that the station could not properly care for the flow during high water conditions and it became apparent that steps must be taken to make other provisions for the disposal of the sewage.

An inspection of the sewerage conditions of the village was consequently made in 1908 by a representative of the Engineering Division at the request of the village authorities and on February 10, 1909, plans prepared in general accordance with the recommendations of this Department were approved. These plans provided for the elimination of the low level or deep sewers and the construction of a high level intercepting sewer in the eastern portion of the village, for the reversal of the flow of sewage in certain sections, and for the conveyance of the entire sewage of the village to a sewage disposal plant consisting of septic tanks and contact beds to be located along Headson creek, a tributary of Ley creek and Onondaga Lake, some 400 feet northeast of the intersection of James and Manlius streets. Permission was granted, however, at the urgent request of the village authorities, for the temporary discharge of effluent from a temporary septic tank to be located at an intermediate point along the outfall sewer.

An inspection of the sewage disposal plant of the village made by a representative of the Department on December 8, 1914, in connection with the general investigation being carried on of sewage disposal plants in the State showed that a temporary septic tank about one-half as large as the one shown by the approved plans had been constructed and that the effluent was being treated with a solution of hypochlorite of lime before its discharge into the stream. Although the infiltration of ground water had been considerably reduced, it was still high and was equal approximately to the flow of sanitary sewage. It was also found that the tank, due to its inadequate size and to the fact that it was practically filled with sludge and scum, gave very unsatisfactory results. It was therefore recommended that a permanent plant be constructed at once and that, until such time as it was completed, the present plant be placed and maintained in an effective operating condition. The permit issued in connection with the approval of the plans for the temporary works above referred to required that the permanent sewage disposal works be constructed and put in operation by March 1, 1914.

The plans now submitted were prepared by Mr. C. E. Higgins, Civil Engineer, of Syracuse, N. Y., and comprise tracings and blueprint copies of the following plans:

1. Two sheets of general plans showing location of outfall sewers and sewage disposal works.
2. Four sheets of profile.
3. Three sheets of details.
4. One sheet showing general layout of and profile to the disposal works.

A copy of the report on the plans by the designing engineer was also submitted with the plans.

These plans show that it is proposed to intercept the existing 18-inch sewer at the first manhole above the present septic tank by a 20-inch sewer and to extend this sewer along Headson creek on a slope of .1 per cent. to the proposed sewage disposal plant to be located some 6500 feet below. The invert in the upper end of this sewer is about four feet below the normal level of the creek and the sewer at the disposal plant is about 1½ feet above this level. An operating head of about 10½ feet is provided for through the disposal plant, so that the effluent pipe from the disposal (which is also to be 20 inches in diameter and is to be extended along the creek on a slope of .075 per cent. for a distance of 4000 feet to a point where a free discharge into the creek may be obtained) will be from 8½ to 10½ feet below the creek level at the disposal plant and from one foot above to about three-fourths feet below the creek at the point of discharge.

It appears, therefore, that the greater portion of the trunk sewer leading to the disposal plant and the outlet sewer from the plant will be under a considerable hydrostatic head at all times and that, unless special precautions are taken in the construction of both these lines to make the joints

sufficiently watertight to exclude ground water infiltrations as far as possible, the unfortunate experience which the village has had in the past in dealing with ground water may be repeated inasmuch as an excessive infiltration of ground water would overtax the disposal plant and thereby make it inoperative or at least ineffective and inefficient. The specifications covering the construction of the proposed sewers were not submitted with the plans and we have, therefore, no definite data as to what steps are to be taken to obtain watertight joints. The designing engineer and village authorities should be urged to give this matter the most careful consideration.

Sewage disposal plant

It is proposed to treat the sewage of the village in a disposal plant consisting of a primary settling tank, sprinkling filter, final settling tank, and a sludge drying bed for the disposal of sludge to be located near Headson creek about 3500 feet north of the village line.

Headson creek at this point has a drainage area of about three square miles and about 4.5 square miles at the point of discharge of the effluent from the plant. Another stream joins the creek about one-half mile below the outlet which increased the watershed to 19.5 square miles. Owing to seepage from the Erie canal, Headson creek has a comparatively large flow. The report of the designing engineer states that the average flow of the creek is about 8 cubic feet per second. At the time of the inspection of the village disposal plant last year, the flow was found to be 7.5 cubic feet per second. Although the stream is not used as a source of public water supply, there are a number of dairy farms located along the stream and these riparian owners have brought suit against the village of East Syracuse and two industrial plants to recover damages and enjoin the village and plants from discharging sewage and waste into Headson creek.

Settling tank

The proposed settling tank is to be a two-story tank of the Imhoff type divided by means of reinforced concrete partitions into two upper settling compartments and two lower sludge compartments. The settling compartments have sufficient capacity to give an average detention of the sewage of about 2½ hours when serving a population of 4,000 persons, assuming a per capita rate of sewage contribution of 100 gallons, which is the basis of design used. The sludge compartment has a capacity of about 2400 cubic feet.

According to the plans, the sewage is to be discharged into the upper end of one of the parallel settling compartments and, after passing through this compartment, will be discharged through two 12-inch by 18-inch openings into a channel located at the opposite end of the tank. From this channel it is to be discharged into the second adjacent compartment through two similar openings and, after passing through this compartment, will flow over a weir into the outlet channel leading to the dosing tank. The proposed arrangement is not satisfactory inasmuch as a large percentage if not all of the sewage would in all probability tend to pass through the slots between the settling compartment to the outlet end of the second compartment without passing through these compartments. The tank should be so designed as to provide for flow in the same direction through both settling compartments. A reversal of the flow of the sewage in order to obtain a more uniform distribution of the sludge in the two sludge compartments may be effected by rearranging the outlet and inlet piping of the tank. The sewage before being discharged into the settling tank should also be passed through a small screen chamber provided with an inclined bar screen composed of bars spaced from 1½ to 2 inches in the clear in order to remove sticks and other large material which would be likely to clog the sludge pipes.

Although the report of the engineer states that the sludge is to be pumped from the sludge well to the sludge bed, the pumping equipment is not shown nor is there any statement as to the kind and size of pumping equipment to be used. The elevation of the different portions of the sludge well

should be shown on the plans and it would be better to have each of the two 8-inch sludge pipes of the settling tank provided with valves in order that either of the two hoppers may be emptied at one time. The sludge storage capacity of the tank should be increased to about 4000 cubic feet in order to provide for a storage period of not less than six months.

Dosing tank

From the settling tank the sewage is to flow by gravity into a hopper-shaped dosing tank provided with a 14-inch discharge siphon. This tank has a capacity of about 3500 gallons and on the basis of design used will discharge the settled effluent into the distributing system of the sprinkling filter once every 13 minutes. The maximum and minimum differences of elevation between the water surface of the dosing tank and the nozzles of the sprinkling filter as shown by the plans are 5 feet and 1 foot respectively. The minimum head on the nozzles should be increased to not less than 1½ feet in order to insure a positive breaking of the siphons under the minimum operating head and a maximum rate of flow of sewage. Unless the rate of discharge of the siphon under a minimum head is greater than the maximum rate of inflow of sewage, the siphon will not break and a continuous flow under a low head will obtain which would give an unsatisfactory distribution. The minimum head could probably be increased by modifying the dosing tank and decreasing the drawing depth of the siphon.

Sprinkling filter

The proposed filter is to be constructed with a plain concrete floor 9 inches thick and gravity section walls from 18 inches to 36 inches thick. The walls are to extend to an elevation of about two feet above the maximum high-water mark of the creek. The filter is to be filled to a depth of five feet with broken stone ranging from 1½ inches to 2½ inches in size, and its area is to be about .3 acre. It will, therefore, be required to operate at a rate of about 1,330,000 gallons per acre per day when serving 4000 persons, which is a moderate rate for the type of filter shown.

The distributing system of the filter is to consist of a 20-inch cast iron main distributor located outside of the filter wall, parallel lines of 6-inch laterals also of cast iron, and circular spray nozzles of the Taylor type spaced 12 feet 8 inches center to center. Each lateral is to be provided with a 6-inch valve, which will permit shutting o ffthe flow to any of the lines for cleaning the nozzles. The underdrain system is to consist of a false floor composed of 6-inch half round tile, 6-inch lateral drains spaced 10.97 feet on centers which in turn discharge into a 12-inch main drain located outside of the filter wall.

The proposed spacing of the nozzles of 12 feet 8 inches is excessive for the low maximum head under which the nozzles are planned to operate. In order to obtain a more uniform distribution of the sewage over the surface of the filter, which is essential to the successful operation of filters of this type, the nozzles should be spaced not more than 10 feet center to center with the maximum head proposed.

Final settling tank

It is planned to pass the effluent from the sprinkling filter through a final settling tank before its discharge into Headson creek. This tank, which is to be located adjacent to the sprinkling filter and surrounded by retaining walls, is also to be a two-story tank of the Imhoff type similar in design to the preliminary tank, except that the flow through the tank will be continuous through both settling compartments from the inlet to the outlet end of the tank. The tank is designed with a settling capacity of about 22,000 gallons, which is equal to an average flow of about 1.3 hours when treating a daily flow of 400,000 gallons. The sludge compartment has a capacity of some 1300 cubic feet.

The tank is to be provided with two 8-inch cast iron sludge pipes by means of which the sludge is presumably to be discharged by gravity flow into a sludge well and then pumped to the sludge drying bed, although this is not clearly shown by the plans. The method of handling the sludge should be clearly shown and each of the two sludge pipes should be provided with a valve.

Sludge bed

This bed, which is to be located near the settling tanks, is to be 50 feet square and is to be filled with graded gravel to a depth of from 10½ to 12 inches and is to have a top layer of mortar sand ¼ inch deep. The bed is to be provided with two lines of 3-inch lateral drains surrounded with gravel and two lines of 4-inch main drains which discharge into the effluent pipe from the final settling tank.

Conclusions and recommendations

In conclusion, I would state that it is found from our careful examination of the plans that the proposed sewage disposal plant, if modified in certain respects as indicated above and if properly constructed and operated, should under ordinary conditions satisfactorily care for the sewage of the village and produce an effluent which may be safely discharged into Headson creek without objection at this time. There are, however, certain structural difficulties of a serious nature which will be met in the construction of the plant owing to the considerable depth below the ground water level that it will be necessary to carry the different structures if installed in accordance with the plans. From a few general computations, it would appear that, under certain conditions, there would be some question as to the stability of the final settling tank against the maximum upward pressure of the ground water. Even if these conditions may be successfully overcome, the cost of construction of the plant, more especially the sprinkling filter and final settling tank, would be very high, owing to the difficulty of making these structures watertight under the high ground water conditions existing at the proposed site. Unless the filter and final settling tank are made sufficiently watertight to prevent excessive infiltration of ground water, the object of constructing the plant will be largely if not wholly defeated.

It is a question whether it would not be more economical and ultimately more satisfactory to provide for a low lift pumping station to pump the sewage through the plant. If pumping is resorted to, a considerable saving in the first cost of construction would be affected not only in connection with the disposal plant but also owing to the elimination of the long outlet sewer and a possible decrease in the length of the sewer leading to the plant since it might be possible to locate the plant nearer the village. The cost of pumping the sewage, moreover, would not be excessive under the present conditions inasmuch as it appears that the infiltration of ground water into the sewer system has been reduced by the elimination of the deep sewers and the construction of the high level sewer in the eastern section of the village and since the head against which it would be necessary to pump the sewage would probably not be more than some 10 feet.

The relative costs of the alternative plans can not be determined by this Department. We can, however, point out the advantages and disadvantages of the two plans and the designing engineer and the village authorities should be advised to give this matter their most careful consideration.

I would, therefore, recommend that the plans be returned to the designing engineer for modifications, revisions, or additions in the following respects:

1. That the specifications provide for making tight joints in both the sewer leading to the plant and the outlet sewer from the plant.
2. That a small screen chamber provided with a bar screen composed of bars spaced from 1½ to 2 inches in the clear be provided.
3. That the settling tank be so designed as to provide for a flow in the same direction through both settling compartments with provision for reversing the flow.

4. That the sludge capacity of the settling tank be increased to 4000 cubic feet.
5. That both of the sludge pipes of the settling tank be provided with valves.
6. That the sludge pumping equipment be shown.
7. That the minimum head on the nozzles be increased to not less than 1.75 feet.
8. That the spacing of the nozzles of the sprinkling filter be not more than 10 feet.
9. That the matter of so remodeling the disposal plant as to provide for pumping the sewage into the plant and thereby permit of raising the general elevation of the plant be given careful consideration.

Respectfully submitted,

THEODORE HORTON,
Chief Engineer

ALBANY, N. Y., *June* 15, 1915

These plans were returned to the designing engineer for revision on June 16, in accordance with the above recommendations.

HERMANN M. BIGGS, M.D., *State Commissioner of Health:*

Revised plans for sewage disposal for the village of East Syracuse, Onondaga county, were submitted to this Department for approval by the board of sewer commissioners of the village on July 8, 1915.

These plans were first submitted for approval on May 29 and after a careful examination of the plans a report was submitted to you under date of June 15, 1915, setting forth the results of the examination and making recommendations for modifications in the plans before the final acceptance of them. The plans were accordingly returned to the designing engineer on June 16 with the recommendation that they be modified in the following respects:

1. That the specifications provide for making tight joints in both the sewer leading to the plant and the outlet sewer from the plant.
2. That a small screen chamber provided with a bar screen composed of bars spaced from 1½ to 2 inches in the clear be provided.
3. That the settling tank be so designed as to provide for a flow in the same direction through both settling compartments with provision for reversing the flow.
4. That the sludge capacity of the settling tank be increased to 4,000 cubic feet.
5. That both of the sludge pipes of the settling tank be provided with valves.
6. That the sludge pumping equipment be shown.
7. That the minimum head on the nozzles be increased to not less than 1.75 feet.
8. That the spacing of the nozzles of the sprinkling filter be not more than 10 feet.
9. That the matter of so remodeling the disposal plant as to provide for pumping the sewage into the plant and thereby permit of raising the general elevation of the plant be given careful consideration.

The plans now submitted should show that they had been revised in general accordance with the above requirements, except with respect to specifications and detail plans of the sludge pump, which the engineer states will be submitted for approval before the contract is started.

A screen chamber has been provided and is to be located adjacent to the preliminary settling tank. This chamber is rectangular in cross section, 2 feet wide and is to be provided with an inclined bar screen composed of ½-inch by 1½-inch bars, 6 feet long and spaced 2 inches in the clear. The invert or bottom of the screen chamber is to be raised slightly.

The design of the settling tank has been so modified as to provide for a

flow in the same direction through both settling compartments and for a reversal of flow of the sewage through the tank.

The tank is to be 38 feet long by 24 feet wide at the top and will have a maximum depth of 27 feet. The capacity of the sludge compartment has been increased to 4,000 cubic feet as recommended and the sludge pipes leading from the settling tank are to be provided with valves. The minimum head on the sprinkling nozzles is to be 1.75 feet and the spacing of the nozzles of the sprinkling filter has been reduced to 10 feet, center to center.

The width of the filter, however, has been decreased, slightly reducing its area from .3 to .275 acres, thereby increasing the rate of operation from 1,330,000 gallons per acre per day to 1,500,000 gallons per acre per day. The proposed rate of operation is not excessive for filters of the depth shown, namely 5 feet.

With reference to our recommendation that consideration be given to the advisability of so remodeling the disposal plant as to provide for pumping the sewage at the plant and thereby permit of raising the general elevation of the plant, portions of which require rather deep cutting and costly construction, the designing engineer in his supplementary report on the plans states that the proposition of providing for the pumping of the sewage had been given careful consideration and abandoned. It is stated that the village has already spent about $30,000 on the old pumping station and sewage disposal works which had to be abandoned on account of excessive pumping charges and that it will, in the near future, be necessary to install a small pumping station to care for certain portions of the northern section of the village. In his opinion the prejudice against pumping is so strong that a proposition to install a pumping station in connection with the disposal plant could not be carried at an election. The report also states that test pits dug in the vicinity of the disposal plant site show that there is a top layer of loam 2 feet thick below which is a stratum of clay and that a test pit 3 feet square and 10 feet deep yielded about 1 gallon of water in 24 hours. Under these conditions it would appear that no serious difficulty from ground water should result provided special precautions are taken in the construction of the disposal plant and the sewers.

In view of the above I would recommend that the plans be approved and a permit be issued allowing the discharge into Headson creek within the town of De Witt of effluent from the proposed sewage disposal plant on condition that specifications of the sewers and disposal plant and detail plans of the sludge pumping stations be submitted for approval before the construction is commenced.

Respectfully submitted,
THEODORE HORTON,
Chief Engineer

ALBANY, N. Y., *July* 20, 1915

PERMIT

Application having been duly made to the State Commissioner of Health, as provided by section 77 of chapter 49 of the Laws of 1909, the "Public Health Law," as amended by chapter 553 of the Laws of 1911, constituting chapter 45 of the Consolidated Laws, permission is hereby given to the sewer commissioners of the village of East Syracuse to discharge effluent from the proposed sewage disposal works to be constructed to treat the sewage from the village into the waters of Headson creek at the point of discharge shown by plans within the town of De Witt in accordance with the plans accompanying the petition, under the following conditions:

1. That this permit shall be revocable at any time or subject to modification or change when in the judgment of the State Commissioner of Health such revocation, modification or change shall become necessary.

2. That the issuance of this permit shall not be deemed to affect in any way action by this Department on any future application that may be made for permission to discharge additional sewage or effluent into the waters of this State.

3. That the sewage disposal works shown by plans approved this day shall be fully constructed in complete conformity with such plans or approved amendments thereof.

4. That only sanitary or domestic sewage, and no storm water or surface water from streets, roofs or other areas shall be admitted to the proposed sewers.

5. That no sewage sludge from any part of the disposal works shall be discharged into Headson creek or any other watercourse or body of water.

6. That detailed plans of the sludge pumping station shall be submitted for approval before the construction of the works is commenced.

LINSLY R. WILLIAMS,
Deputy State Commissioner of Health

July 23, 1915

EASTVIEW (Loeb Convalescents Home)

HERMANN M. BIGGS, M.D., *State Commissioner of Health:*

Plans showing alterations to the sewage disposal plant to treat the sewage from the Loeb Convalescents' Home, at Eastview, Westchester county, were submitted by the designing engineers on August 6, 1915. A duplicate plan was not received, however, until August 18, 1915. The City-Waste Disposal Company, of which Mr. G. Everett Hill is vice-president, prepared the plan.

The records of the Department show that original plans for sewage disposal for the Loeb Convalescents' Home were approved on May 21, 1906. On December 17, 1914, an investigation of the sewage disposal plant was made by a representative of the engineering division and recommendations in regard to improving the operation of the plant were made.

An examination of the plan submitted for approval shows that it differs only slightly from the plans approved in 1906. The plan shows that it is proposed to add a cinder barrier on the irrigation field, and a study of the contours shows that the grade between the cinder barriers is to be less steep. Shallow trenches filled with stone are also shown behind the barriers. A letter from the designing engineer describes fully the merits of the plans and of the improvements which are generally in accord with the views and recommendations of this Department. Particular attention should be called, however, to the fact that the unsatisfactory results recently observed concerning this plant were due largely to inattention and improper maintenance and it is very important that more care be exercised in the future in regard to the operation of this plant. In fact a plant of this type should be under the general supervision or oversight of a sewage disposal expert and it would be well if the plant were inspected at regular intervals through the year.

In view of the results of our examination of these plans, I beg to recommend that they be approved and that the Loeb Convelescents' Home authorities be urged to not only exert unusual care in the future in the maintenance of this plant but if possible provide for the general expert supervision above suggested.

Respectfully submitted,
THEODORE HORTON,
Chief Engineer

ALBANY, N. Y., *August* 19, 1915

The plans were approved on August 24, 1915.

FARMINGDALE (N. Y. State School of Agriculture on Long Island)

HERMANN M. BIGGS, M.D., *State Commissioner of Health:*

Amended plans for sewage disposal for the New York State School of Agriculture on Long Island near Farmingdale, Nassau county, were submitted to this Department for approval on May 5, 1915.

Original plans for a sewage disposal plant for this institution consisting of a screen chamber, pumping station, settling tanks to be operated in connection with electrolizers and a broad irrigation system were approved on July 10, 1914, and on December 24, 1914, amended plans for a portion of the proposed electrolytic plant were approved.

The plans now submitted have been prepared in general accordance with the suggestions of this Department and provide for so remodeling the three settling tanks as to convert them into Imhoff tanks and for the substitution of liquid chlorine treatment of the effluent from the settling tanks for the electrolizers provided for by the original plans. The feature of applying lime to the sewage discharged into the settling tanks is to be retained. The plans, however, are general, only one elevation and very few dimensions being shown on the settling tanks.

Although the operation of the proposed sewage disposal plant involves pumping the sewage into the settling tanks no data have been submitted as to the pumping equipment and the manner of operating the pumps. I am of the opinion that the pumping should be as continuous as possible in order to get a fairly uniform flow of sewage through the tanks and a resultant uniform application of chemicals. This can be accomplished either by hand operated pumps and constant attendance or by properly designed and automatically operated pumps set to start and stop at certain predetermined elevations of the sewage in the suction well. The method of accomplishing the desired results should be shown on the plans and specifically stated.

The proposed tanks are to be of the horizontal flow type and the piping connecting the inlets and outlets of the tanks are so arranged that either of the first two tanks may be operated independently; or the first two, the second and third or all three tanks may be operated in series; or the first two may be operated in parallel. A greater flexibility of operation would be obtained by having an additional branch discharge pipe and an additional lime feed line connected with the third settling tank in order to permit of operating all three of the tanks in parallel, which would reduce considerably the velocity of flow through the tanks should this be desired in the future when it is expected that a considerably larger population will be tributary to the plant than when it is first installed.

Each tank is to be 20 feet in diameter and 22 feet deep and is to be divided into one settling compartment and one sludge compartment. The combined settling capacity of the three tanks if constructed in accordance with the typical section shown by the plans will be equal to about seven hours flow of sewage based on an estimated ultimate daily flow of 100,000 gallons which was the basis used in the design of the original plans. The combined capacity of the sludge compartments is equal to about 1,500 cubic feet.

A 6-inch sludge pipe extending to a point near the bottom of each tank is to be provided. These pipes are to form the suction pipes of the sludge pump by means of which the sludge from the settling tanks is to be pumped into the proposed filter press as provided for by the original plans.

Inasmuch as it is proposed to use lime as a precipitating agent in connection with the operation of the Imhoff tanks, it is probable that a rather heavy compact sludge will be obtained unless it is removed daily. It would be advisable, therefore, to install one or two rings of perforated lead water pipe in each of the sludge compartments in order to loosen the sludge and facilitate its removal.

The effluent from the Imhoff tanks is to be treated with liquid chlorine. The chlorine machines are to be of the Wallace and Tiernan type and are to be installed in duplicate in the building containing the lime tanks, sludge pump and filter press. The chlorine is to be conveyed through some 75 feet of

pipe to a diffusion chamber to be constructed on the effluent pipe below the lower settling tank. This chamber is to be 14 inches by 12 inches and about 10 feet deep, and is to be provided with a baffle. The chlorine is to be applied through a diffuser at a point about 7 feet below the invert of the effluent pipe.

From the diffusion chamber it is planned to discharge the treated effluent through some 250 feet of 8 inch pipe to the broad irrigation field. A small disinfection chamber having a capacity equal to at least 15 minutes flow of sewage should be installed below the diffusion chamber.

In view of the above and after careful consideration of the general and local requirements for sewage disposal, I would recommend that the plans be returned for modification or additions in the following respects:

1. The plans should be submitted in duplicate.
2. The plans should show additional details and dimensions.
3. The sewage pumping equipment should be shown and the proposed method of providing for continuous pumping of the sewage should be stated.
4. One or more rings of perforated lead water pipe should be installed in each of the sludge compartments of the settling tanks and shown by the plans.
5. A disinfection chamber giving a detention period of not less than 15 minutes should be installed below the diffusion chamber and shown by the plans.

Respectfully submitted,

THEODORE HORTON,

Chief Engineer

ALBANY, N. Y., *May* 7, 1915

The plans were returned to the State Architect for revision on May 10, 1915, in accordance with the above recommendation.

HERMANN M. BIGGS, M. D., *State Commissioner of Health:*

Revised plans showing modifications of the original plans for the proposed sewage disposal plant for the New York State School of Agriculture on Long Island near Farmingdale, were submitted to this Department for approval by the State Architect on May 27, 1915.

These plans which were prepared by the Briante Construction Company, were first submitted for approval on May 5, 1915, and after a careful examination of them by the Engineering Division a report was submitted to you under date of May 7, 1915, setting forth the results of this examination and making recommendations for certain modifications before the final acceptance of them. The plans were accordingly returned to the State Architect on May 10, 1915, with the following recommendations:

1. The plans should be submitted in duplicate.
2. The plans should show additional details and dimensions.
3. The sewage pumping equipment should be shown and the proposed method of providing for continuous pumping of the sewage should be stated.
4. One or more rings of perforated lead water pipe should be installed in each of the sludge compartments of the settling tanks and shown by the plans.
5. A disinfection chamber giving a detention period of not less than 15 minutes should be installed below the diffusion chamber and shown by the plans.

The plans now submitted show that they have been revised in general accordance with all of the above recommendations. The plans were submitted in duplicate and show additional details and dimensions as required. The location of the proposed sewage pumps are shown by the plans and the specifications stipulate that the pumping equipment is to be the same as specified in the original specifications which provide for duplicate units of

motor driven vertical submerged 3-inch centrifugal pumps controlled by floats and automatic starters. These pumps are to have a capacity of 240 gallons per minute each. The specifications also provide that gate valves are to be installed on the discharge line from each pump to permit of throttling down the discharge to suit the average delivery of sewage in order to provide for as constant and uniform flow of sewage into the settling tank as possible. It appears that the proposed arrangement should be an effective means of obtaining the desired condition of flow.

The plans also provide for a ring of 1½-inch perforated lead water pipe to be installed near the bottom of each of the sludge compartments of the settling tanks. The perforations of the water pipe are to consist of 3/16-inch holes spaced 8 inches center to center.

A disinfection chamber 7 feet by 5 feet in plan inside dimensions having a depth below the flow line of 5 feet, 7 inches, is to be installed on the effluent pipe below the chlorine diffusion chamber. This tank has sufficient capacity to provide for an average time of detention of the treated effluent of about 20 minutes under an average condition of flow of 100,000 gallons per day.

Although the specifications state that each of the duplicate chlorinating apparatus shall be capable of treating independently a continuous flow of sewage from the sedimentation tank of 6,000 gallons per hour and that the apparatus shall be so designed as to allow for easy and accurate control of the chlorine with a variation of from ¼ to 2½ times the normal flow, no statement is made as to the amount of liquid chlorine to be used in disinfecting the sewage. Not less than 5 parts of chlorine per million parts of sewage or about 42 pounds of liquid chlorine per million gallons of sewage treated should be used at all times.

From our careful examination of the plans it is found that the proposed modifications have been made in general accordance with the requirements of this Department and I am of the opinion that the proposed sewage disposal plant, if properly constructed and if operated with care and efficiency, should satisfactorily care for the sewage of the institution. I would, therefore, recommend that plans be approved on condition that not less than 42 pounds of liquid chlorine per million gallons of sewage treated shall be at all times applied uniformly to the affluent from the settling tanks.

Respectfully submitted,

THEODORE HORTON,
Chief Engineer

ALBANY, N. Y. *May* 28, 1915

The plans were approved on May 29, 1915, on condition that not less than 5 parts of liquid chlorine per million parts of sewage created shall be at all times uniformly applied to the effluent from the settling tanks.

FARNHAM (Fort Stanwix Canning Co.)

HERMANN M. BIGGS, M.D., *State Commissioner of Health:*

Plans for the disposal of wastes and sewage from the factory of the Fort Stanwix Canning Co. in the Village of Farnham, Erie county, were submitted to this Department for approval on April 8, 1915.

The matter of the proper disposal of wastes from this canning factory has been before the Department from time to time since July 15, 1911, when the condition of pollution of Mud creek caused by the discharge of wastes from the factory was brought to the attention of the Department by the local Board of Health. The question of treating the wastes from the canning factory was taken up with the canning company through the local Board of Health and as a result of this action an application for a permit to discharge wastes was received from the United States Canning Company under date of August 3, 1911. On August 31, 1911, a permit was issued to this company allowing the discharge into Mud creek of effluent from a settling tank to treat the wastes and washings from the canning factory. Some time

later the factory was taken over by the Fort Stanwix Canning Company which was considered to have succeeded to the permit.

It was found from inspections made by representatives of this Department on October 14, 1913, and August 1, 1914, as the result of complaints of the continued pollution of the stream that the conditions of the permit issued on August 31, 1911, had not been fully complied with. At the recommendation of this Department the Fort Stanwix Canning Company engaged the services of engineers to make a study of the problem of properly disposing of its wastes. Experiments and preliminary studies of a laboratory nature were made in connection with the waste products of the factory by the United States Public Health Service during the early part of last fall.

Plans for a large scale experimental plant based on these experiments and studies were prepared by the United States Public Health Service and submitted for approval on April 8, 1915, as noted above. A communication received from a representative of the United States Public Health Service states that the plant at Farnham is to be operated during the coming season by one of their representatives and that the plant will be modified in accordance with the results of this year's experiments. Studies are also to be made upon wastes which are now hauled away and dumped upon land.

According to the report of the Sanitary Chemist who carried on the experiments last year the following conclusions were drawn from the results of the tests made:

1. If the wastes are allowed to settle 4 hours practically all of the settleable suspended matter can be removed.
2. The sludge deposited on the bottom of the settling tanks decomposes very readily and rises to the surface and with tanks of the design now in use at the canning factory the sludge must be pumped out by hand once a week.
3. The design of the settling tank should be such that the sludge section will be separate from the flow section and sludge removal made possible without pumping it out by hand. The latter feature will permit the withdrawal of a small amount of sludge from the tank every morning and tend to prevent active decomposition.
4. Sludge beds should be prepared of such capacity and subdivided so the daily quantity of sludge drawn off can be kept separate from the partially dried sludge.
5. All the wastes should be screened through fine mesh wire screens 30 mesh to the lineal inch.
6. Pea vine and silo liquors should have a storage in wells or tanks of at least 24 hours and then passed through sand beds at least 4½ feet deep before they are allowed to enter the main sewer leading to the final purification plant.
7. During the tomato season every precaution should be taken to keep down the amount of pulp entering the sewers. That which enters the sewers should be settled in tanks for at least 4 hours and the supernatant filtered through sand before allowed to go to the final disposal plant.
8. The effluent from the settling tank if passed through 5 feet of coarse lake sand at a rate of 500,000 gallons a day will be stable.

The plans for sewage and waste disposal now presented show that it is proposed to treat the sewage and waters of the factory in a sewage disposal plant consisting of a screen chamber, settling tank of the Imhoff type, plain settling tank, sand filter and sludge drying bed. The wastes are to pass through the different portions of the plant by gravity flow.

Screen chamber

This chamber which is to be located in front of the Imhoff tank is to be 5 feet long, 2 feet wide and 2 feet deep and is to contain one ¼-inch mesh screen and 1 screen with 30 meshes to the lineal inch. The wastes are to pass successively through the course and fine screens.

Imhoff tank

The proposed Imhoff tank is to be 20 feet long, 14 feet wide with a maximum depth of about 105 feet below the flow line. It is to be divided by means of wooden partitions into two upper horizontal flow settling compartments and two hopper shaped sludge compartments. The two settling compartments are to be connected with a 12-inch pipe. The combined settling capacity of the two settling compartments is equal to about 2 hours flow based on an average hourly flow of 3,500 gallons during 10 hours of the day and 4 hours if based on the average daily flow. This is about one-half the capacity originally recommended by the United States Public Health Service in a preliminary report.

Each of the two sludge compartments is to be provided with a 6-inch sludge pipe by means of which the sludge is to be discharged to the sludge drying bed. According to the report submitted with the plans the sludge is to be removed from the tanks daily.

Plain settling tank

From the Imhoff tank the settled effluent is to be passed through a plain settling tank which will give an additional subsidence period of nearly 8 hours. This tank is the tank in use at present and is to be modified by removing the existing revolving screen and so reconstructing the outlets as to increase the settling capacity. An outlet trough leading to the sand filter is also to be installed.

Sand filter

The effluent from remodeled settling tank is to flow continuously by gravity to the sand filter. This filter is to have a superficial area of 3,000 square feet and is to be operated at the rate of about 500,000 gallons per acre per day. The filtering material is to consist of a top layer of sand having an average depth of about 4½ feet and a lower layer of cinders or gravel about 6 inches deep. The distributing system is to consist of a main wooden trough 10 inches wide by 6 inches deep from which is to extend lateral troughs 5 inches wide by 3 inches deep. The bed is to be underdrained by means of parallel lines of 4-inch tile which are to connect with a central drain 10 inches in diameter which is to discharge into Mud creek.

Sludge bed

This bed is to be 20 feet square and is to be filled to a depth of 4 feet with filtering material consisting of 1.5 feet of sand and 2.5 feet screened cinders. The effluent collected by the underdrains is to be discharged into the stream without further treatment.

Conclusions and recommendations

In conclusion I would state that it appears from our examination of the plans and data submitted with them that the proposed sewage disposal plant if properly constructed and if operated with care and efficiency should produce a stable effluent under the conditions existing at the time that the experiments and tests were made. It is probable, however, that the time of detention in the Imhoff tank may be found to be smaller than desirable to give the best results and that it will be necessary to enlarge it to correspond more nearly with the recommendations of the preliminary report of the Public Health Service dated November 2, 1914. It is also probable that the sand filter will have to be enlarged somewhat in order to prevent a rapid clogging of the bed and a consequent high cost of maintenance.

Further studies and experiments are to be made by the U. S. Public Health Service during the coming season in order to determine what changes, if any, it will be necessary to make in the construction and operation of the plant in

order to obtain satisfactory results. It would appear therefore, that the plans may consistently be approved contingent upon the satisfactory operation of the plant and on the condition that it be modified or enlarged if found necessary.

Respectfully submitted,
THEODORE HORTON,
Chief Engineer

ALBANY, N. Y., *April* 13, 1915

PERMIT

Application having been duly made to the State Commissioner of Health, as provided by section 77 of chapter 49 of the Laws of 1909, the "Public Health Law," as amended by chapter 553, of the Laws of 1911, constituting chapter 45 of the Consolidated Laws, permission is hereby given to the Fort Stanwix Canning Company to discharge effluent from the works to treat the sewage and wastes from the factory of said company at Farnham, N. Y., into the waters of Mud creek at the point of discharge shown by the plans within the municipality of Farnham in accordance with the plans accompanying the petition, under the following conditions:

1. That this permit shall be revocable at any time or subject to modification or change when in the judgment of the State Commissioner of Health such revocation, modification or change shall become necessary.
2. That the issuance of this permit shall not be deemed to affect in any way action by this Department on any future application that may be made for permission to discharge additional sewage or effluent into the waters of this State.
3. That no sewage sludge from any part of the disposal works shall be discharged into Mud creek or into any other watercourse.
4. That whenever required by the State Commissioner of Health satisfactory detailed plans for changes in or additions to the works for treatment of the sewage and wastes from the factory shall be submitted for approval; and that after approval of said plans such changes in or additions to the said works shall be constructed and put in operation at such time or times thereafter as said Commissioner may designate.

LINSLY R. WILLIAMS,
Deputy State Commissioner of Health

April 13, 1915

FREDONIA

HERMANN M. BIGGS, M.D., *State Commissioner of Health:*

Amended plans for sewerage and sewage disposal for the village of Fredonia, Chautauqua county, were submitted to this Department for approval by the Board of Trustees on February 16, 1915.

Plans for extensions and modifications of the village sewer system for intercepting and outfall sewers and for sewage disposal plant consisting of septic tanks, contact beds and an auxiliary sluge bed for the disposal of sludge were approved on April 13, 1914. Although the population of the village at that time was estimated at 5,660, the disposal plant was designed to care for a population of 7,000 which population it was assumed would obtain in about 20 years, based on the past growth of the village.

The plans now submitted and under consideration provide for the substitution of settling tanks of the Imhoff type and a sprinkling filter for the septic tank and contact beds provided for by the plans approved last year. It appears from the letter of the designing engineer, transmitted with the plans, that the Board of Trustees after investigating the matter of sewage disposal, concluded that the proposed method of treatment would be more efficient than that originally planned for.

The proposed plant is to be located at practically the same site as the first plant; that is, near the northeasterly bank of Canadaway creek about

6. That whenever required by the State Commisioners of Health satisfactory detailed plans for secondary settling tanks for the treatment of the effluent from the sprinkling filter shall be submitted to this Department for approval and that such tanks shall be constructed and put in operation whenever required by the State Comissioner of Health.

LINSLY R. WILLIAMS,
Deputy State Commissioner of Health

February 24, 1915

GOSHEN

HERMANN M. BIGGS, M.D., *State Commissioner of Health:*

Plans providing for a modification of a portion of the sewer system of the village of Goshen, Orange county, submitted to this Department for approval by the Board of Trustees on March 26, 1915.

Original plans for sewerage and sewage disposal for the village of Goshen were approved by this Department on January 13, 1914. These plans provided for an 8-inch sewer in Murray avenue between North Church and Erie streets. The eastern portion of this sewer was planned to be tributary to Erie street and the western portion was shown connected with the North Church street sewer.

The plans now submitted show that it is proposed to abandon the sewer in Murray avenue and to construct an 8-inch sewer through the middle of the block on each side of Murray avenue to serve this street. According to the report of the designing engineer and the application of the Board of Trustees. the proposed change is desired inasmuch as the sewer if built as originally planned would require deep cutting through solid rock. The proposed sewer north of Murray avenue is to be tributary to the North Church street sewer and the sewer south of Murray avenue is to be connected with the Montgomery street sewer which in turn discharges into the North Church street sewer.

It was found from our examination of the plans that the proposed sewers if properly constructed should satisfactorily care for the sewage of the section to be served by them and I would therefore recommend that the plans be approved. It will not be necessary to issue a permit in connection with the approval of these plans inasmuch as they do not contemplate the discharge of any additional sewage not provided for by the original plans and inasmuch as one of the conditions on which the original plans were approved is as follows:

> That both the sewer system and the sewage disposal works shown on the plans approved this day shall be fully constructed in complete conformity with such plans or approved amendments thereof.

Respectfully submitted,
THEODORE HORTON,
Chief Engineer

ALBANY, N. Y., *March* 27, 1915

The plans were approved on March 29, 1915, in accordance with the above recommendation.

GOWANDA (Tannery of C. Moench Sons Co.)

HERMANN M. BIGGS, M.D., *State Commissioner of Health:*

Plans for the disposal of waste and sewage from the tannery of C. Moench Sons Co., at Gowanda, Cattaraugus county, were submitted to this Department for approval on August 17, 1915.

The tannery, which has been in operation since 1864 is located on Cattaraugus creek about one mile south of the central portion of the village of Gowanda. This stream has a drainage area of about 440 square miles at

this point and discharges into Lake Erie about 15 miles below Gowanda. It is not used as a source of water supply below Gowanda. Below the tannery Cattaraugus creek receives the sewage and wastes from the Eastern Tanners Glue Company, the sewage from the village of Gowanda and from the Gowanda State Homeopathic Hospital. Steps have been taken by the Department to require at least a partial treatment of the sewage from these places before its discharges into the creek.

An inspection of the tannery with special reference to the pollution of the creek by wastes from the tannery and from the Eastern Tanners Glue Company was made by a representative of the Department on March 8, 1915. A report setting forth the results of this inspection was submitted to you under date of March 17, 1915. This report described the nature of the operations carried on at the tannery, the nature and amount of wastes discharged therefrom and outlined in general the steps that should be taken by the company to provide for the treatment of its wastes, the discharge of which were found to create objectionable conditions in the stream.

The plans now presented were submitted in accordance with the recommendations of this Department and were prepared by Metcalf & Eddy, consulting engineers, Boston, Mass. They were accompanied by a report of the designing engineers and comprise 5 sheets of blue prints on cloth showing general and detailed plans of the proposed sewerage and sewage disposal system.

According to the report of the engineers the sewage and wastes from the tannery are at present discharged into Cattaraugus creek through four sewers designated as the Main sewer, Sewer No. 1, Sewer No. 2 and the Beam House sewer. These sewers receive in addition to industrial wastes and sanitary sewage from toilets, a considerable amount of surface drainage and other wastes such as blow-off water from boilers which do not require treatment. The flow of wastes is estimated at about 170,000 gallons per day and the design is based on a flow of 200,000 gallons.

It is proposed to provide for the separation of the storm water from the more objectionable wastes and to discharge the storm water and the wastes not requiring treatment into the creek through the main sewer. Sewer No. 1, serving the Leach House, is to be abandoned and the leakage from the pumps in this house is to be collected in a concrete sump, pumped out and utilized. The waste liquors from the wringers now discharged into Sewer No. 2 are to be pumped out and utilized. The wastes from the storage vats, which it is stated are not objectionable, are to be discharged directly into Cattaraugus creek through sewer No. 2 as at present. These vats, it is stated, can be removed to another building and discharged into the disposal plant if necessary. A new sewer is to be constructed to intercept the sewage requiring treatment now being discharged into the main. This new sewer will also receive the sewage from the Beam House sewer. The lower portion of the proposed sewer is to be 18 inches in diameter with a slope of .18 per cent. and the upper portion is to be 12 inches in diameter with a slope of .3 per cent.

All of the wastes and sewage collected by this sewer are to be conveyed to the sewage disposal plant, consisting of a settling tank, storage tank, sludge drying bed and pumping station for the pumping of the sludge. The plant is to be located between the buildings of the tannery and the creek. An area has also been reserved for future extensions of the plant. The flow line of the settling and storage tanks is at elevation 93 and the top of the walls of these structures is at elevation 94. It is stated that as near as can be ascertained the maximum high water of the creek is at an elevation of from 91 to 95. The low water mark of the stream is 85. It appears, therefore, that the operation of the plant will not be seriously interfered with by reason of high water conditions in the stream.

The sedimentation tank is divided by means of a concrete wall into two compartments about 41 feet long. One of the compartments is to be 24 feet 8 inches wide and the other about 21 feet 4 inches wide. The depth below the flow line of the narrower of the two compartments varies from 6½ to 7½

Sons Company to discharge effluent from the proposed works to treat the wastes from the tannery of said company at Gowanda into the waters of Cattaraugus creek near said tannery within the municipality of Gowanda in accordance with the plans accompanying the petition, under the following conditions:

1. That this permit shall be revocable at any time or subject to modification or change when in the judgment of the State Commissioner of Health such revocation, modification or change shall become necessary.
2. That the issuance of this permit shall not be deemed to affect in any way action by this Department on any future application that may be made for permission to discharge additional sewage or effluent into the waters of this State.
3. That no sludge from any part of the disposal works shall be discharged into Cattaraugus creek or any other watercourse.
4. That the sludge drying beds shown in general by the plans shall be constructed with their nearest point not less than 50 feet from Cattaraugus creek and that their construction shall conform to the recommendations of the report of the designing engineer's submitted with the plans.
5. Whenever required by the State Commissioner of Health all sanitary or domestic sewage shall be separated from the wastes and treated in works constructed under plans satisfactory to this Department.
6. That whenever required by the State Commissioner of Health the treatment works shall be enlarged or works for additional treatment shall be provided in accordance with plans satisfactory to this Department.

LINSLY R. WILLIAMS,
Deputy State Commissioner of Health

September 17, 1915

GREECE (Sewer District No. 1)

HERMANN M. BIGGS, M.D., *State Commissioner of Health:*

Plans for an extension of Sewer District No. 1 in the town of Greece, Monroe county, known as Annexed District No. 2, were submitted to this Department for approval by the sewer commissioners of Sewer District No. 1 of the town of Greece on November 13, 1915.

Plans for sewerage and sewage disposal for Sewer District No. 1 of the town of Greece were approved on April 29, 1914. These plans provided for a sanitary sewer system and preliminary treatment works consisting of a screen chamber and included general plans for supplementary or more complete treatment works consisting of sedimentation tank, sprinkling filter and hypochlorite treatment plant.

Permission was asked by the sewer commissioners before the approval of the plans to temporarily omit from construction the sewage disposal works and to be allowed to discharge the sewage into the Genesee river through an existing outfall sewer in Hanford Landing road. This application was granted in view of the polluted condition of the Genesee river, which receives the sewage of the city of Rochester, and since it was expected that the area north of the city, including Sewer District No. 1, would in the near future be annexed to the city, in which case the sewage from the district would be intercepted and conveyed to the sewage disposal works under construction by the city, provisions having been made in the design of the intercepting sewer and disposal works to care for the sewage from a limited territory north of the city.

It was pointed out in the report on the examination of the plans for Sewer District No. 1, dated April 29, 1914, that if the sewage from the proposed sewer system was not cared for by the city within a reasonable time in the future it would be necessary to provide for a sewage disposal plant constructed along the lines indicated by the general plans for sewage disposal

then submitted. The permit issued in connection with the approval of the plans on April 29, 1914, accordingly contained the following conditions:

> "5. That when required by the State Commissioner of Health the sewage disposal plant shown by plans approved this day shall be constructed and put in operation; and when required by said commissioner, satisfactory detailed plans for additional works for more complete treatment of the sewage of district shown generally by these plans or approved amendments thereof shall be submitted for approval and upon approval of said plans any or all portions of such additional or supplementary works for more complete treatment of sewage shall be constructed and put in operation at such time or times thereafter as said commissioner shall designate."

The plans now submitted cover an area of some 540 acres lying west and north of Sewer District No. 1. It is bounded approximately by the Erie canal and Eddy street on the south and west; Ridgeway avenue, the Ridge road and Sewer District No. 1 on the north and by the Buffalo, Rochester and Pittsburgh R. R. and Sewer District No. 1 on the east.

According to the report of the designing engineer submitted with the plans the present population of annexed district No. 2 is 600 and it is estimated that the ultimate future population will be about 15,000 giving a density of population of nearly 30 persons per acre. The water consumption is estimated at 100 gallons per capita per day. It is stated in the report that the district is being rapidly built up as a residential section although a portion along the railroad will be reserved for manufacturing purposes. The report states also that except for the limited amount of roof water and cellar drainage no storm water will be admitted to the sewers.

The proposed sewer system is to be tributary to the main outlet sewers of Sewer District No. 1 which discharges into the Genesee river at the foot of Hanford Landing road. The sewers in the northerly portion of the district are to discharge into the existing sewer in the Ridge road and the southerly section of the district into the sewer in Deneve avenue. In order to care for the additional amount of sewage that will be collected by the proposed sewers the plans show that it is proposed to increase the existing 8-inch sewer in the Ridge road in sewer district No. 1 to 12 inches in diameter and increase the slope of the sewer from .35 per cent. to .37 per cent. The sewer in Deneve avenue east of the railroad, the upper portion of which is now 8 inches and the lower portion 15 inches in diameter is to be increased to 18 and 24 inches in diameter. The slope of the 18-inch sewer in the upper portion of Deneve avenue is to be .3 per cent. and the slope of the 24-inch sewer in the lower portion of this street is to be the same as originally planned, namely .25 per cent.

The proposed sewers of the annexed district are to vary from 8 to 15 inches in diameter and are to be constructed with slopes sufficiently steep to provide self-cleansing velocities under ordinary conditions. Flush tanks are to be installed at the upper ends of the lateral sewers and in some cases double flush tanks will be installed at high points of the sewer lines from which the sewers slope in opposite directions. Manholes are shown at all points of change of slope and alignment and at intermediate points on straight slopes at various distances apart. In a few instances such as in the upper end of Driving Park avenue where there is a distance of 950 feet from a flush tank to the nearest manhole the spacing of the manholes is excessive and should be reduced. Manholes should in general not be spaced more than from 400 to 500 feet apart and in no case should the spacing exceed 600 feet.

Some of the proposed sewers are laid in comparatively deep cut and it is probable that considerable ground water will be encountered in the construction of these sewers such as in Woodward avenue and other streets. Special precautions should be taken in such cases to make the joints as water-tight as possible in order to exclude excessive amounts of infiltration of ground water. The house connections should also be laid with tight joints with a view of excluding ground water as far as practicable.

From our examination of the plans it is found that the proposed sewers if properly constructed should satisfactorily care for the sanitary sewage of the section to be served by them. The storm water should however be eliminated from the sewers.

With respect to the discharge of untreated sewage into the Genesee river it may be stated that the conditions are practically the same as when the plans for Sewer District No. 1 were approved last year in that the sewerage from the city of Rochester is still being discharged without treatment into the Genesee river although the disposal works under construction by the city are nearing completion. It would appear therefore that approval might reasonably be given for the temporary discharge of sewage into the Genesee river through the existing outfall sewer from district No. 1, at the foot of Hanford Landing road. In case the area covered by the sewer district is not annexed by the city and its sewage cared for within a reasonable time provisions should be made by the sewer commissioners to treat this sewage in a sewage disposal plant constructed along the lines indicated by the plans approved on April 29, 1914. It would however be necessary to construct a larger plant than that shown by the approved plans owing to the comparatively large additional area made tributary to the sewer system of Sewer District No. 1 by the plans now under consideration.

I would therefore recommend that the plans be approved and a permit issued allowing the temporary discharge of sewerage from the proposed sewer into the Genesee river at the foot of Hanford Landing road and that the permit contain in addition to the usual revocation and modification clauses the same conditions with reference to the disposal of the sewage of the district as contained in the permit issued on April 29, 1914.

Respectfully submitted,

THEODORE HORTON,

ALBANY, N. Y., *November* 26, 1915 *Chief Engineer*

PERMIT

Application having been duly made to the State Commissioner of Health, as provided by section 77 of chapter 49 of the Laws of 1909, the "Public Health Law," as amended by chapter 553 of the Laws of 1911, constituting chapter 45 of the Consolidated Laws, permission is hereby given to the Sewer Commissioners of Sewer District No. 1, town of Greece, Monroe county, to discharge sewage temporarily from the proposed sewers in Annexed District No. 2 of Sewer District No. 1 into the waters of Genesee river at the foot of Hanford Landing road extended within the municipality of Rochester in accordance with the plans accompanying the petition, under the following conditions:

1 That this permit shall be revocable at any time or subject to modification or change when in the judgment of the State Commissioner of Health such revocation, modification or change shall become necessary.

2 That the issuance of this permit shall not be deemed to affect in any way action by this Department on any future application that may be made for permission to discharge additional sewage or effluent into the waters of this State.

3 That the sewer system shown by plans approved this day shall be fully constructed in complete conformity with such plans or approved amendments thereof.

4. That only sanitary or domestic sewage and no storm water or surface water from streets, roofs or other areas shall be admitted to the proposed sewers.

5. That when required by the State Commisioner of Health the sewage disposal plant shown by plans for Sewer District No. 1 approved on April 29, 1914, shall be constructed and put in operation; and when required by said Commissioner satisfactory detailed plans for additional works for more complete treatment of the sewage of Sewer District No. 1 shown generally by the plans approved on April 29, 1914, or approved

amendments thereof shall be submitted for approval and upon approval of said plans any or all portions of such additional or supplementary works for more complete treatment of sewage shall be constructed and put in operation at such time or times thereafter as said Commissioner shall designate.

LINSLY R. WILIAMS,
Deputy State Commissioner of Health

December 4, 1915

GREENWICH

HERMANN M. BIGGS, M. D., *State Commissioner of Health:*

General plans for sewerage and sewage disposal for the village of Greenwich were submitted to this Department for approval on October 27, 1915.

Greenwich is an incorporated village in the southerly portion of Washington county and lying on either side of the Battenkill. The Greenwich & Johnsonville R. R. and the Hudson Valley Railway pass through the village. The population of the village is approximately 2,300.

The water supply of the village of Greenwich is derived from Fly creek, without filtration, at a point 3½ miles south of the village. At times an auxiliary supply is derived from the Battenkill, a polluted stream passing through the village. A ruling of the Conservation Commission requires chlorination of this latter supply before use.

The records of the Department show that no plans for sewers in the village have ever been approved by this Department. There are at present, however, several private sewers and particularly party sewers in Main and other streets which discharge into the Battenkill near Bridge street.

The plans now submitted were prepared by Mr. Chas. E. Perry, consulting engineer, of Albany, N. Y., and comprise a general topographical sewer plan in duplicate, a map and profile of proposed sewers to be constructed in Elm avenue, Main and Bridge streets with connecting sewers at street intersections to be extended later into the lateral streets intersecting Elm avenue and Main streets. It is proposed also to construct all house connections under the proposed paving. The sewers in these three streets are shown in detail and it is proposed to incorporate the existing sewer in Main street in the proposed general sewer plan.

It is proposed in 1916 to construct a brick pavement in Elm avenue, Main and Bridge streets at the joint cost of the State and village. The village authorities have been notified by the State Commissioner of Highways that the village must lay in the streets to be paved all pipes which they expect to need during the next fifteen years and also that such pipes should be laid the year previous to the work of paving. The authorization by the taxpayers has been given to the construction of these sewers and portions of sewers in the three streets named necessary to form a part of the general system and an engineer has been engaged by the village authorities to prepare detailed plans for a general system of sewerage and sewage disposal for the village but owing to the limited time available between the time of decision regarding the construction of the sewers in these three streets and the close of the present working season it will not be possible to prepare detailed plans for the entire sewer system. For this reason the village authorities have submitted for approval a general plan covering the entire village and providing for a comprehensive sewer system and sewage disposal plant and have submitted for approval detailed plans for the proposed sewers in Elm avenue, Main and Bridge streets which will form a part of the general sewer system for the village.

The proposed sewers in these three streets are in the nature of lateral sewers tributary to the main trunk sewers which will form a part of the general sewer system and for this reason the design of these sewers can at this time be worked out without the completion of the detailed design of the general sewer system.

The proposed new sewers shown by the plans range in size from 8 to 12 inches and have sufficient gradients to produce self-cleansing velocities. The manhole spacing, the depth of the sewers and other features of a hydraulic and construction nature appear to be satisfactory.

No sewage will be admitted to the proposed sewers and these sewers will have no outlets and cannot be used by the village until the remainder of the general sewer system is constructed.

In view of the above I beg to recommend that the plans submitted be approved on condition that detailed plans of the general sewer system for the village and detailed plans of sewage disposal works to treat the entire sanitary sewage of the village be submitted for approval on or before February 1, 1916.

No permit is necessary in connection with the approval of these plans at this time since no increased sewage discharge is possible or contemplated by the construction of the proposed sewer.

In accordance with the provisions of section 260 of the Village Law, however, it will be necessary that application be made by the board of trustees for the temporary omission from construction of all portions of the permanent general sewer system except the sewers now proposed to be constructed as shown by the detailed plans submitted.

Respectfully submitted,
THEODORE HORTON,
Chief Engineer

ALBANY, *October* 29, 1915

The plans were approved on October 29, 1915, on the following conditions:

1. That no sewage shall be admitted to the sewers now proposed to be constructed as shown by the detailed plans submitted until detailed plans for the entire system of sewerage and sewage disposal for the village have been submitted to and approved by this Department and a permit issued for discharge of sewage therefrom, and such general system of sewers or portions thereof constructed.

2. That none of the sewers shown by the general plans for which detailed plans are not now submitted shall be constructed until detailed plans for said sewers have been submitted to and approved by this Department.

3. That detailed plans for the general system of sewerage and sewage disposal for the village shall be submitted to this Department for approval on or before February 1, 1916.

4. That such changes or modifications in the detailed plans for the general sewer system approved this day as may be required by this department shall be made before these plans are approved or the sewer system constructed.

The village was also notified that in accordance with Section 260 of the Village Law it would be necessary to apply to this Department for permission to temporarily omit the portions of the permanent general system of sewerage and sewage disposal not shown in detail by the plans submitted.

Application for permission to temporarily omit the portions referred to was received by the village president on November 3 and on November 22 the following permit was granted to the board of trustees of the village of Greenwich:

In the Matter of the Application of the Village of Greenwich for the Temporary Omission of Certain Portions of the Permanent General System of Sewers and Sewage Disposal for the village, made under the provisions of Article XI, Section 260, of the Village Law.

WHEREAS the Board of Trustees of the village of Greenwich have duly made application in compliance with Article XI, Section 260 of the Village Law for the temporary omission from construction of a portion of the permanent general system of sewers and sewage disposal for the village of Greenwich, plans for which were approved by this department on October 29, 1915, to wit:

All of the said permanent general system of sewers and sewage disposal with the exception of the sewers in Elm avenue, Main and Bridge streets and,

WHEREAS, it is deemed advisable to the interests of said village that the construction of such portions of the permanent general system of sewers and sewage disposal be temporarily omitted or deferred,

Now, therefore, I, LINSLY R. WILLIAMS, Deputy State Commissioner of Health, acting under the authority vested in me by said Article XI, Section 260 of the Village Law, do hereby approve of the temporary omission of said sewers, this twenty-second day of November, 1915.

LINSLY R. WILLIAMS,
Deputy State Commissioner of Health

ALBANY, N. Y.

HUDSON (Fairground Boulevard Section)

HERMANN M. BIGGS, M.D., *State Commissioner of Health:*

Plans for sewerage and sewage disposal for a small tract known as the Fairground Boulevard section in the city of Hudson, Columbia county, were submitted to this department for approval on March 6, 1915.

The plans were prepared by the Green-Starr Engineering Company, civil and sanitary engineers of Philadelphia, and comprise tracings and blueprints of three sheets showing general plans and details of the sewerage and sewage disposal systems. Although no detailed statements were submitted as to the exact location of Fairground Boulevard it appears from the plans that it is situated partly in the city of Hudson and partly in the town of Greenport as the easterly city line is shown extending through the central portion of the property. The population of the tract, according to a note on the plans is 250 and the design is based on a daily sewage contribution of 100 gallons per capita.

The plans show sewers in Oakwood, Parkwood and Glenwood Boulevards. These sewers vary in size from 6 to 10 inches in diameter and are to be provided with manholes at all changes of slope or alignment. Although profiles of the sewers are shown, the scale to which the map and profiles are drawn is not indicated and it is, therefore, impossible to determine with any degree of accuracy the slopes of the proposed sewers.

It is proposed to treat the sewage collected by the proposed sewers in a sewage disposal plant located near a small stream which flows through the property at a point of from 50 to 100 feet from the intersection of Parkwood and Oakwood Boulevards. It is stated in a report of the engineers that this stream flows through the northern portion of the city of Hudson and discharges into North bay, an arm of the Hudson river. No statement was submitted with the plans, however, as to the size and nature of the stream nor as to the area of the watershed drained by it.

The proposed sewage disposal plant is to consist of a settling tank, precipitation tank, contact bed, sprinkling filter and intermittent sand filter covered with a 6-inch layer of stone. The settling tank is a covered single compartment tank about 12 feet long, 10 feet wide, and about 10 feet deep, and will give a time of detention of about 8 hours when serving the estimated population of 250 persons on the usual assumptions as to per capita rates of sewage contribution.

From the settling tank the sewage is to be discharged by gravity into an adjacent so-called precipitation tank. This tank is 5 feet wide, 10 feet long, and about 10 feet deep, and is provided with two baffles, one extending down from the roof of the tank, the other up from the bottom of the tank. The capacity of this tank is equal to an average flow of about 3 hours on the basis of design used.

It is planned to discharge the effluent from the precipitation tank into a contact bed which according to the plans and report of the engineers is to be filled to a depth of three feet with broken stone. A 10-inch discharge siphon discharging into the distributing system of the sprinkling filter is

shown located near one side of the contact bed. It does not appear, however, that this siphon is partitioned off so as to separate it from the filtering material of the contact bed. This bed has an area of about .01 of an acre and would be required to operate at the rate of 3,500,000 gallons per acre per day.

This rate of operation is entirely too high and would undoubtedly cause a rapid clogging of the bed resulting in a high cost of maintenance. The design of the contact bed and the method of operation due to the design are not satisfactory. A properly designed contact bed should be divided into not less than 4 units so arranged as to operate alternately and provide for proper periods of resting and contact. This would necessitate the installation of time discharging siphons in order to regulate the time of contact. The filter, moreover, should not be less than 4 feet in depth and should be provided with a proper system of underdrains. The rate of operation of contact beds should not be more than 100,000 gallons per acre per day per foot of depth of the filter.

According to the plans the contact bed effluent is to be discharged under a maximum head of about 7.5 feet into the distributing system of the sprinkling filter. This filter is to be filled to a depth of 5 feet with 2-inch broken stone and is planned with an area of .024 acres. The rate of operation on the basis of design used would therefore be about 1,000,000 gallons per acre per day. The distributing system of the filter is to consist of an 8-inch cast iron pipe with four 2-inch laterals spaced about 12 feet apart. Although the spray nozzles are not shown on the plans, it would appear from the plans that the nozzles are to be fastened direct to the ends of the lateral distributors and at three points along the line of the main distributor, inasmuch as no riser pipes are shown and since the distributing system lies practically on the surface of the filter. The underdrain system is to consist of two lines of 6-inch tile which are shown connected with the two main distributors of the sand filter.

The type of nozzle to be used should be shown and the distributing system should be laid not less than 18 inches below the surface of the filter in order to prevent freezing. Filters of this type should also be provided with false floor underdrain systems in order to facilitate aeration and drainage. Owing to the fact that considerable solids are given off from sprinkling filters and considering the fact that the effluent is to be treated on sand filters the sprinkling filter should be supplemented with a final settling tank in order to remove the solids and prevent them from clogging the sand filter.

The proposed sand filter is designed with an area of about .1 acre and is to be filled to a depth of 3 feet with sand. It is planned to place a 6-inch layer of 2-inch stone over the sand and around the distributing system which is to consist of parallel lines of tiles laid with open joints. The filter is to be underdrained by means of two 6-inch underdrains. The rate of operation on the filter as planned would be about 250,000 gallons per acre per day. This rate of operation is high and especially so considering the fact that it is proposed to place a layer of stone over the surface of the filter which will prevent the proper inspection and cleaning of the filter. If the filter is to be covered in this manner the rate of operation should be reduced to not more than 50,000 gallons per acre per day.

It appears from our examination of the plans that the proposed sewage disposal plant is not properly designed. In view of the fact that it is proposed to finally treat the effluent by means of sand filters, it should not be necessary to provide for both contact bed and sprinkling filter treatment before discharging the effluent to the sand filters. If the contact beds are to be used these beds should be divided into four units and should be provided with proper dosing and time discharge devices in order to give proper cycles of operation, inasmuch as it is necessary to the successful operation of filters of this type that means should be provided for resting the different units for 5 or 6 hours and for giving a shorter but appreciable period of contact. The contact beds, moreover, should not be less than 4 feet deep and should be designed to operate at a rate of not more than 100,000 gallons per acre per foot of depth of filter. In order to prevent objectionable odors from

emanating from the contact beds if retained it would be well to place a 6-inch layer of stone above the flow line of the beds.

If the sprinkling filter is to be used it should be covered owing to its location in close proximity to the street. It should also be provided with proper dosing devices and final settling tanks should be provided to treat the effluent before its discharge to the sand filters. The sand filter should be open in order that it may be readily accessible for cleaning and inspection. If it is considered necessary to cover the filter it might be covered by a building provided with a roof divided into sections which could be readily removed.

I would, therefore, recommend that the plans be returned to the designing engineers in order that additional data may be submitted and the following additions and changes be made.

1. That a location map such as a United States topographical sheet showing the location of the sewage disposal plant be submitted.
2. That a statement as to the nature and size of the stream receiving the effluent, be submitted.
3. That the plans for sewage disposal be revised to comply with the requirements stated above.
4. That the department be advised as to the name or names of the owners of the Fairground Boulevard section.

Respectfully submitted,
THEODORE HORTON,
Chief Engineer

ALBANY, N. Y., *March* 30, 1915

The plans were returned to the designing engineer for revision on April 5, 1915, in accordance with the above recommendation.

HERMANN M. BIGGS, M. D., *State Commissioner of Health:*

Revised plans for sewerage and sewage disposal for the Fairground Boulevard section in the city of Hudson, were resubmitted to this department for approval on May 11, 1915.

These plans were first submitted for approval on March 6, 1915, and after a careful examination of them by the engineering division, a report was submitted to you under date of March 30, 1915, setting forth the result of the examination and making recommendations for certain modifications in the plans before the final acceptance of them. The plans were accordingly returned to the designing engineer for revision on April 5, 1915.

Plans revised in general accordance with the requirements as set forth in the report dated March 30, and providing for a settling tank, precipitation tank, dosing tank, sprinkling filter and sand filter, where resubmitted on April 26. It was found, however, that the plans were not in satisfactory condition for approval and they were again returned to the engineer on April 27 with the recommendation that the dosing tank be enlarged and that the distributing system of the sand filter be modified and so arranged as to permit of throwing one unit of the filter out of use for resting and cleaning.

The plans now submitted show that the size of the dosing tank has been doubled by increasing its length from 5 to 10 feet and that a trough distributing system is to be substituted for the proposed tile distributors of the sand filters shown by the plans submitted. The distributing system of the sand filters is to be provided with gates in order to permit of throwing different portions of the filters out of use as may be required.

The proposed settling tank is practically of the same size as shown by the original plans and will give a time of detention of about 7 hours when serving the estimated population of 250 persons which is the basis used in the design. The dosing tank will have a capacity of about 750 cubic feet. A sprinkling filter which is to be filled to a depth of 6 feet with broken stone 1 inch in size, is to have an area of .025 acres and will, therefore, be required to operate at the rate of 1,000,000 gallons per acre per day.

The effluent from the sprinkling filter is to be discharged into the distributing system of the proposed sand filter. This filter is to have an area

of .1 acre and is to be filled to a depth of 3½ feet with sand under which is to be placed a layer of gravel from 1 foot to 1½ feet in depth. The sand filter will be required to operate at the rate of 250,000 gallons per acre per day when serving the ultimate future population of the tract. This rate is somewhat high for filters of this type and the filter will, therefore, require careful supervision and maintenance.

According to data submitted by the designing engineer and the owner of the realty development, the stream into which it is proposed to discharge the effluent rises near the property and discharges into a small pond known as Underhill pond, located about one-half mile below the disposal plant. This pond which is used for ice cutting in the winter overflows into a stream tributary to the Hudson river.

From our careful examination of plans it would appear that the proposed sewage disposal plant, if properly constructed and operated with care and efficiency, should satisfactorily care for the sanitary sewage from the section to be served by it and should produce an effluent which may be safely discharged into the stream without objection at this time. The number of persons tributary to the disposal plant should, however, be limited to 250 and provision should be made to sterilize the effluent by liquid chlorine should such treatment be found necessary in the future.

I would, therefore, recommend that plans be approved and a permit be issued allowing the discharge of effluent from the proposed sewage disposal plant into the stream tributary to the Hudson river and that the permit contain in addition to the usual revocation and modification clauses the following conditions:

1. That the population tributary to the disposal plant shall be limited to 250 persons unless the disposal plant shall be increased in accordance with plans approved by this department.

2. That whenever required by the State Commissioner of Health, provision shall be made for sterilizing the effluent from the sewage disposal plant.

Respectfully submitted,

THEODORE HORTON,
Chief Engineer

ALBANY, N. Y., *May* 19, 1915

PERMIT

Application having been duly made to the State Commissioner of Health, as provided by Section 77 of Chapter 49 of the Laws of 1909, the "Public Health Law," as amended by Chapter 553 of the Laws of 1911, constituting Chapter 45 of the Consolidated Laws, permission is hereby given to Leander H. Weaver to discharge effluent from the proposed sewage disposal plant to be constructed in connection with the proposed sewer system in the Fairground Boulevard district, Hudson, into the waters of a stream tributary to the Hudson river at a point shown by plans within the municipality of Hudson in accordance with the plans accompanying the petition, under the following conditions:

1. That this permit shall be revocable at any time or subject to modification or change when in the judgment of the State Commissioner of Health such revocation, modification or change shall become necessary.

2. That the issuance of this permit shall not be deemed to affect in any way action by this department on any future application that may be made for permission to discharge additional sewage or effluent into the waters of this State.

3. That both the sewer system and the sewage disposal works shown by plans approved this day shall be fully constructed in complete conformity with such plans or approved amendments thereof.

4. That only sanitary or domestic sewage, and no storm water or surface water from streets, roofs or other areas shall be admitted to the proposed sewers.

5. That no sewage sludge from any part of the disposal works shall be discharged into the tributary of the Hudson river or into any other watercourse or body of water.

6. That whenever required by the State Commissioner of Health the effluent from the plant shall be properly sterilized in accordance with plans satisfactory to this department.

7. That the amount of sewage to be treated in the disposal works shall be limited to that contributed by 250 persons unless the disposal plant shall be increased in accordance with plans approved by this department.

LINSLY R. WILLIAMS,
Deputy State Commissioner of Health

May 27, 1915

HUNTINGTON (Sewer District)

HERMANN M. BIGGS, M.D., *State Commissioner of Health:*

Plans for a sanitary sewer system and for sewage disposal works for the sewer district of the town of Huntington, Suffolk county, were submitted to this department for approval by the sewer commissioners thereof on March 15, 1915.

These plans were first submitted for approval on February 3, 1915, and given a preliminary examination by the engineering division which showed that certain features of the design required modification before the plans could be finally passed upon. The plans were accordingly returned to the designing engineer on February 4, 1915, with the recommendation that they be modified in the following respects:

1. It is believed that in view of the change of location of the disposal plant from the location previously adopted to the northeast of New York road and in view of the excessive tides which are experienced every two or three years in this bay, that all the superstructures over the sewage disposal works shown upon the plans be removed and in their place the side walls be raised to a sufficient level to reasonably safeguard the plant against flooding from the maximum tides, this method of inspection being preferable to earth dikes surrounding the plant.

2. That in lieu of the superstructures shown upon the plans and in order that suitable provisions may be made for housing the chlorinating plant and sludge pumps and to afford convenient working and tool-house accommodations a new house be provided over or near the inlet manhole to the disposal works.

3. That a liquid chlorine plant be substituted for the hypochlorite plant as shown, and that this liquid chlorine plant be so constructed as to operate automatically. This change is considered essential to more efficiency and with great certainty provide for the sterilization of the effluent from the plant before its discharge.

4. That in order to prevent back water in the sewers during times of high tides the portable sludge pump to be installed should be power driven and have a capacity of at least 250 gallons per minute and that arrangements be made to permit temporarily of the utilizing of this pump for pumping sewage from the outfall sewer during times of flood due to maximum tides.

5. That provision be made and fully covered in the specifications for complete exclusion of ground water from the system of sewers and particularly from all house connections by means of some effective method of watertight pipe joints, this provision being very necessary for the successful and economical operation of the system.

6. That further detailed description and, if necessary, additional plans be submitted showing the method of operation of the discharge valve from the storage tank with a statement as to whether the same is to be operated automatically or by hand.

It is found from our examination of the plans now submitted that they have been revised in accordance with the above recommendations. The plans which were prepared by George W. Fuller, consulting engineer, New York city, comprise tracings and blue print showing general and detailed plans of the proposed sewer system and sewage disposal works. Duplicate copies of specifications and report of the designing engineer were also submitted.

The sewer district is located in the northwestern part of the town of Huntington on the southerly shore of Huntington Harbor. Although the district is provided with a public water supply, it appears that the sewage at present is cared for largely by means of cesspools and that general insanitary conditions have resulted in this portion of the town by the overflow from these structures.

The question of sewage disposal for this portion of the town of Huntington has been before the department for a considerable time and repeated efforts have been made by the department during the past few years in trying to induce the town to remedy the objectionable conditions caused by the use of cesspools by providing for suitable means for the collection and disposal of the sewage.

Plans now presented have been carefully examined with respect to the sewer system and sewage disposal works. In connection with the sewer system the design has been studied with reference to alignment, size, grades, capacities, facilities for cleaning and inspection and flushing, and other features of a hydraulic or sanitary nature. In connection with means for sewage disposal, the design has been studied with reference to general method and efficiency of the sewage disposal works as a whole and to the capacities and practical operation of the individual structures, appurtenances and apparatus.

Sewer system

The proposed sewer system is to consist of some 15 miles of sewers ranging in size from 6 to 15 inches in diameter. Except the sewer in the lower portion of New York avenue, Cross street and Creek road near the disposal plant, which is to be constructed of cast iron pipe, the sewers are, for the most part, to be constructed of vitrified tile pipes. As recommended by this department, the specifications provide for making the joints as tight as practicable in order to prevent excessive infiltration of ground water.

The proposed sewers are to be constructed with slopes sufficiently steep to provide self cleansing velocities under ordinary conditions and the capacities of the trunk sewers appear to be adequate to care for two or three times the present population on the usual consumptions as to per capita rate of sewage contribution. Manholes are to be constructed at all points of change of slope or alignment and at intermediate points at distances of from 300 to 400 feet. Automatic flush tanks are to be provided at the upper ends of all lateral sewers.

It is proposed to treat the sewage collected by proposed system in a sewage disposal plant located south of the Mill dam pond and about 500 feet west of New York avenue. The effluent from the plant is to be discharged into the head of Huntington Harbor through some 1,200 feet of 15-inch pipe to be laid in Creek road and New York avenue. The average tidal range at this point is from 7 to 8 feet.

Sewage disposal works

The proposed sewage disposal works is to consist of settling tanks of the Imhoff type, a storage basin, sterilizing apparatus and auxiliary sludge beds for the disposal of sludge. The plant is to be surrounded by an earthen embankment, the top of which is to be 2.5 feet above high tide and the walls of the settling tanks and storage basin are to be carried up 4½ feet above the mean high tide to protect the plant from flooding at times of maximum high water in the harbor. It is stated in the report of the designing engineer that it is estimated that during the first year after construction of the system the flow to the disposal works will be about 100,000 gallons per day and that within the next few years the flow will reach about 300,000 gallons per day which is the basis used in the design of the disposal plant.

Settling tanks

The proposed settling tanks are to be two story tanks of the Imhoff type, divided into three sections so arranged that one or more sections may be operated at one time. Provisions are also made for reversing the direction of flow through the tanks. Each section is 49 feet, 3 inches long, 11½ feet wide with a maximum depth below the flow line of 10 feet inside dimensions. There are to be two upper settling compartments and five lower hopper shaped sludge compartments in each section. The combined settling capacity of the tanks is about 35,000 gallons and will give an average detention of the sewage of about 2.8 hours when caring for an average flow of 300,000 gallons per day. The sludge compartments have a capacity of about 3,000 cubic feet which should be adequate to provide for about six months' storage of the sludge on the basis of design used.

Sludge removal

The sludge is to be removed from the sludge compartments and discharged to the sludge drying beds by means of a portable centrifugal pump driven by a gasoline engine. This pump which is also to be used to pump effluent from the plant to the outfall sewer under conditions of maximum high tides, is to have a capacity of 500 gallons per minute equal to 720,000 gallons per day.

Sterilization

According to the specifications the effluent from the Imhoff tanks is to be treated by means of chlorine gas and although no definite statement is made as to the amount of chlorine to be added to the sewage, the specifications call for a machine having a capacity of from 5 to 50 pounds per day, equal to from 2 to 20 parts per million on the basis of the flow of 300,000 gallons per day. I am of the opinion that owing to the nature of the body of water to receive the effluent, not less than 5 parts of chlorine per million parts of sewage should be used in treating the effluent from the settling tanks and that this amount should be increased if found necessary to produce a satisfactory effluent.

Storage tanks

A storage tank 78 feet long, 38 feet wide, and 4½ feet deep below the flow line, giving a capacity of 100,000 gallons, is to be provided to store the treated effluent from the Imhoff tanks so that the effluent may be discharged into the harbor only on the outgoing tide. It is planned to discharge the effluent from the tank into Huntington Harbor during the first four hours of the ebb tide. The discharge is to be controlled by an automatic tide gate, located in a small building which is also to contain the sterilizing apparatus. The effluent pipe from the storage tank is to consist of some 1,200 feet of vitrified tile terminating in three lengths of cast iron pipe. This pipe is to discharge into Huntington Harbor below the low water mark so that the outlet will be submerged at all stages of the tide.

Sludge beds

The plans provide for two sludge drying beds, 20 feet by 30 feet in plan, giving a combined area of 1,200 square feet. These beds are to be filled with 12 inches of graded broken stone or gravel, covered with a thin layer of sand. The underdrains from the sludge beds are to discharge into the storage tank.

Conclusions and recommendations

From our examination of the plans, it is found that the proposed sewer system and sewage disposal plant should satisfactorily care for the sanitary sewage of the sewer district for the present and allow for a reasonable increase in the population in the future. The sewage disposal plant, if properly operated, should produce an effluent that may safely be discharged into Huntington Harbor without objection at this time.

I would, therefore, recommend that the plans be approved and a permit be issued allowing the discharge into Huntington Harbor in the town of Huntington of effluent from a proposed sewage disposal works on condition that not less than 5 parts of chlorine per million parts of sewage treated shall be applied to the effluent from the Imhoff tanks and that this amount shall be increased whenever required by this department.

Respectfully submitted,
THEODORE HORTON,
Chief Engineer

ALBANY, N. Y., *April* 1, 1915

PERMIT

Application having been duly made to the State Commissioner of Health, as provided by Section 77 of Chapter 49 of the Laws of 1909, the "Public Health Law," as amended by Chapter 553 of the Laws of 1911, constituting Chapter 45 of the Consolidated Laws, permission is hereby given to the Sewer Commissioners of the town of Huntington to discharge effluent from the sewage disposal works to be constructed in connection with the proposed sewer system in the sewer district of the town of Huntington into the waters of Huntington Harbor near the intersection of New York avenue and Mill Dam road within the town of Huntington in accordance with the plans accompanying the petition, under the following conditions:

1. That this permit shall be revocable at any time or subject to modification or change when in the judgment of the State Commissioner of Health such revocation, modification or change shall become necessary.
2. That the issuance of this permit shall not be deemed to affect in any way action by this department on any future application that may be made for permission to discharge additional sewage or effluent into the waters of this State.
3. That both the sewer system and the sewage disposal works shown by plans approved this day shall be fully constructed in complete conformity with such plans or approved amendments thereof.
4. That only sanitary or domestic sewage, and no storm water or surface water from streets, roofs or other areas shall be admitted to the proposed sewers.
5. That no sewage sludge from any part of the disposal works shall be discharged into Huntington harbor or any other watercourse.
6. That chlorine gas shall be applied uniformly to the effluent from the settling tanks in the proportion of not less than five parts of the gas to 1,000,000 parts of effluent before it is discharged into Huntington harbor and that this proportion shall be increased when required by the State Commissioner of Health, in accordance with plans to be submitted to and approved by this Department.
7. That whenever required by the State Commissioner of Health, satisfactory detailed plans for additional works for more complete treatment of the sewage of the sewer district of the town of Huntington shall be submitted for approval; and upon approval of said plans any or all portions of such additional or supplementary works for more complete treatment of sewage shall be constructed and put in operation at such time or times thereafter as said commissioner may designate.

LINSLY R. WILLIAMS,
Deputy State Commissioner of Health

April 3, 1915

ILION

HERMANN M. BIGGS, M.D., *State Commissioner of Health:*

Plans for sewer extensions to the sewerage system of the village of Ilion, Herkimer county, including Barringer road, Concord, New, Water, Spruce and other streets, were submitted by the board of sewer commissioners on

July 22, 1915. A formal application for the approval of the plans and for permission to connect with the existing sewers in the village of Ilion was received on August 6, 1915.

The records of the Department show that original plans for a comprehensive sewer system, pumping station and sewage disposal works were approved by the then State Board of Health on January 16, 1893, and that on August 25, 1893, amended plans were approved showing changes of alignment of the outfall sewer and changes of location of the sewage disposal plant. On January 16, 1894, amended plans, providing for changes of alignment, sizes and grades of certain sewers in the village, in such a way as to eliminate pumping of the sewage and thereby converting the entire system of the village into a gravity system, were approved.

In 1910 and 1911 plans for extensions of the village sewer system were approved, and the permits issued in connection with the approval of these plans, contain, in addition to the usual revocation and modification clauses, the requirements that plans for sewage disposal be submitted on or before January 1, 1912, and the disposal plant built and put in operation by September 1, 1912. Plans for sewage disposal works were approved on June 25, 1912, and on August 28, 1912, a permit was issued extending the time for the construction of the sewage disposal works.

The plans now submitted show that it is proposed to construct sewer extensions in three separate areas, the principal of which areas lies northeast of Steeles creek on both sides of the N. Y., W. S. & B. R. R., comprising extensions in Avenue A, W. North street, Water street, Spruce and other streets.

The proposed sewers for this portion of the village are all 8-inch sewers, laid on grades ranging from 0.10 per cent. to 0.25 per cent., with the exception of the ejector force main, which is to be cast iron pipe laid on a grade of 0.3 per cent. In the report of the consulting engineer of the then State Board of Health on the proposed changes to eliminate a pumping station it is stated that, "The grades proposed by this change of plan vary from 0.10 to 0.25 for distances not exceeding 1,500 feet," but the sizes of the sewers are not stated. The map of sewers submitted in accordance with the Public Health Law of 1903 shows 8-inch sewers in this region with grades as low as 0.1 per cent. Grades of 0.2 per cent. and 0.25 per cent. are too flat to insure self-cleansing velocities in sewers and prevent clogging, and although these 8-inch sewers, which have been laid on grades as low as 0.1 per cent., may not have given trouble due to clogging, this is probably due to good fortune rather than to good design.

In the present instance it would involve little additional cost to place the ejectors at an elevation sufficiently low to secure grades for the 8-inch sewers of at least 0.3 per cent., and if possible 0.35 per cent., which would insure self-cleansing velocities in the sewers and prevent clogging.

The proposed sewers all discharge by gravity to a manhole in Railroad street on the northeast side of the N. Y., W. S. & B. R. R., where are to be located two 50-gallon Shore ejectors, which are apparently to raise the sewage so that it will discharge by gravity through cast-iron pipe under the railroad tracks.

A flush tank is shown beyond the railroad on one of the tracings, a manhole is shown on the other and a lamphole is shown on the profile, and there is therefore some doubt as to its exact nature. Unless the flush tank on the southwestern side of the railroad tracks is already built and in use it would appear unnecessary to provide a flush tank at this point since the intermediate discharge of the ejector will have the same effect in flushing out the sewer. A lamphole would not provide adequate means for inspecting and cleaning the sewer. A manhole should be used.

Two 50-gallon ejectors will have a maximum capacity of about 144,000 gallons per day, which, at the rate of sewage contribution of 100 gallons per day, will be sufficient for the sewage from 1,440 people, which should be adequate to provide for the needs of the region in question.

Flush tanks are to be placed at the upper ends of all laterials. The maximum spacing between manholes is slightly over 800 feet in the sewer

in Spruce street, and as this sewer is 8 inches in diameter and shown with a grade of 0.2 per cent., it is probable that this sewer will clog because of insufficient velocity of flow of the sewage to keep the sewer flushed out and the grade of the sewers should not only be made steeper but manholes should be placed in the sewers wherever the spacing between manholes exceeds 500 feet in order to provide adequate means for inspection and cleaning the sewers.

The plans submitted for approval also show sewer extensions in Newton, Concord and W. Fifth avenue, which will discharge into the existing sewerage system of the village at two points, namely, at the intersection of Charles street and W. Fifth avenue and at the intersection of Barringer and Second streets. These sewers are all to be 8-inch sewers laid on grades ranging from 0.50 per cent. to 4.0 per cent and should therefore have sufficient slope to provide self-cleansing velocities in the sewers and prevent clogging. Flush tanks are to be provided at the upper ends of all laterals and the spacing between manholes is not excessive. It appears, therefore, that adequate provision will be made for inspection and cleaning of the sewers in this section.

Short extensions in New and Elm streets are also shown on the plans. The New street extension is to be an 8-inch sewer with a slope of 0.25 per cent. and will discharge into an existing sewer in Otsego street, while the Elm street sewer is to be the extension of an existing sewer and will be 8 inches in diameter laid on a grade of 1.45 per cent. Both extensions are to have flush tanks at their upper ends, and although the distance from the flush tank at the upper end of the extension in Elm street to the first manhole below it is about 550 feet, due to the steep grade of the sewer and to the flush tank, no trouble should be experienced with clogging of this extension. The profile of the New street sewer shows that at its upper end it is to be only 4 feet below the surface of the ground, therefore it would probably not be practicable to increase the grade in this sewer by raising its upper end. However, as its length does not exceed 400 feet and a flush tank is to be placed at its upper end, it may be that by proper care no trouble will be experienced with this sewer.

In view of the results of our examination of these plans and after careful consideration of the essential features of the design and of the requirements for the proper care of the sewage from these extensions I beg to recommend that these plans be approved on the following conditions:

1. That the grades of the sewer extensions of those sewers lying north of the Erie canal be either increased to at least 0.3 per cent. and to 0.35 per cent. if possible or that the size of the sewers be increased and provided with appropriate slopes.
2. That the maximum spacing between manholes be not greater than 500 feet.
3. That a manhole be constructed at the end of the force main from the ejector station.

Respectfully submitted,

THEODORE HORTON,
Chief Engineer

ALBANY, N. Y., *August* 11, 1915

PERMIT

Application having been duly made to the State Commissioner of Health as provided by section 77 of chapter 49 of the Laws of 1909, the "Public Health Law," as amended by chapter 553 of the Laws of 1911, constituting chapter 45 of the Consolidated Laws, permission is hereby given to board of sewer commissioners of the village of Ilion to discharge sewage from the proposed sewer extension in Barringer road, Concord, New, Water, Spruce and other streets into the waters of Mohawk river through existing outlet sewers within the municipality of Ilion, in accordance with the plans accompanying the petition, under the following conditions:

1. That this permit shall be revocable at any time or subject to modification or change when in the judgment of the State Commissioner of Health such revocation, modification or change shall become necessary.

2. That the issuance of this permit shall not be deemed to affect in any way action by this Department on any future application that may be made for permission to discharge additional sewage or effluent into the waters of this State.

3. That only sanitary or domestic sewage, and no storm water or surface water from streets, roofs or other areas shall be admitted to the proposed sewers.

4. That the gradients of the proposed sewer extensions north of the Erie canal be either increased to at least 0.3 per cent. and to 0.35 per cent. if possible, or that the size of the sewers be increased and that these sewers be constructed with appropriate slopes.

5. That the maximum spacing between manholes be not greater than 500 feet.

6. That a manhole be constructed at the end of the force main from the ejector station.

LINSLY R. WILLIAMS,
Deputy State Commissioner of Health

August 20, 1915

LITTLE VALLEY (Cattaraugus County Court House)

HERMANN M. BIGGS, M. D., *State Commissioner of Health:*

Plans for sewage disposal for the Jail and County Court House at Little Valley, Cattaraugus county, N. Y., were submitted to this Department for approval on July 6, 1915.

These plans were first submitted for approval on June 3, at which time a preliminary examination was made of the plans, which showed that there were certain features of the design which were not satisfactory and that they did not contain sufficient data to permit of finally passing upon them. Plans were accordingly returned to the designing engineer on June 9 with the recommendation that the county property and adjacent buildings, the location of the proposed sewage disposal plant with reference to the various buildings, the slope of the ground and the location of wells, if any be shown, and that additional data as to the local conditions of soil and topography be furnished.

According to the report furnished by the designing engineer and one of the supervisors of the county, the Court House and Jail has an average population of 35 with a maximum of about 100 during the court sessions. It is also stated that there is no well within 1,000 feet of the disposal plant. Although the village of Little Valley is provided with a water supply system, there are no public sewers in the village and the sewage from the county buildings is at present cared for by a small settling tank and cesspools, which are said to be inadequate.

The plans now show that it is proposed to care for the sewage from the county buildings in a sewage disposal plant consisting of a settling tank, dosing chamber and four absorption pits. The settling tank which is to be constructed of concrete is to be covered and provided with manhole openings. It is to be 22 feet long, 7 feet wide and 8 feet deep inside dimensions, with a depth of flow of 6 feet. The settling capacity of the tank when clean is equal to a flow of from 16 to 48 hours, assuming a daily per capita rate of sewage contribution of 100 gallons per day. The report of the designing engineer states that the tank was purposely made somewhat large, owing to the fact that prisoners allow the water to run from the faucets continually and that it has been impossible to stop this practice. The sewer leading to the settling tank is to be provided with a branch line and valves which will permit of using the existing settling tank while the proposed tank is being cleaned. The new tank is also to be provided with a sludge pipe, by means of which the sludge may be discharged by gravity flow to trenches and covered over.

From the settling tank the effluent is to flow under a baffle and over a weir into a dosing chamber provided with a 5-inch automatic discharge

siphon, by means of which the sewage is to be discharged into four absorption pits. Three of the pits are to be 8 feet in diameter and the fourth 16 feet in diameter. They are to be from 14 to 15½ feet deep and are to be filled with broken stone and provided with vent pipes. According to the report of the designing engineer the first 13 feet of soil penetrated is clay and hardpan and below this to the bottom of the pits is a coarse, clean gravel, suitable for the absorption of the effluent.

From our examination of plans it would appear that the proposed sewage disposal plant, if properly maintained, should care for the sewage from the county buildings. There is no certainty, however, as to how long the absorption pits will operate without clogging. If the pits clog up it will be necessary to clean them or to construct new pits, there being considerable area available for the construction of additional absorption pits should the four pits shown by the plans prove to be inadequate to satisfactorily care for the sewage.

I would, therefore, recommend that the plans be approved. It should not be necessary to issue a permit, however, inasmuch as no discharge of effluent into any stream is contemplated by the plans.

Respectfully submitted,

THEODORE HORTON,

ALBANY, N. Y., *July* 19, 1915 *Chief Engineer*

The plans were approved on July 27 in accordance with the above recommendations.

LONG BEACH

HERMANN M. BIGGS, M.D., *State Commissioner of Health:*

Plans for proposed sewer extensions in the village of Long Beach, Nassau county, were submitted to this Department for approval by the board of trustees on May 12, 1915. A formal application for approval of the plans was received on May 19, 1915.

According to the data submitted by the designing engineer, the village of Long Beach includes some 450 acres situated between Laurelton and Monroe boulevard, the Board walk and Water street in the central portion of the Long Beach estates. The village was incorporated in 1913, at which time it had a population of 230 persons.

Plans for sewerage and sewage disposal for the western portion of Long Beach west of Monroe boulevard were approved by this Department on March 16, 1910. The proposed sewer system provided for by these plans covers an area between Lafayette boulevard, Market street, Park street, Monroe street and the Board walk. The sewers vary in size from 8 to 30 inches in diameter. The proposed sewage disposal plant, consisting of three settling tanks and a detention chamber, is located on the western end of Park street. This disposal plant was designed to care for an ultimate population of 5,000 people and provided for the discharge of settled sewage into Broad or Long Beach channels on the outgoing tide, the discharge to continue to within two hours of the time of low tide. On September 9, 1912, plans for a hypochlorite plant to treat the effluent from the settling tanks were approved.

The plans now presented cover the northeastern and northwestern sections of the village north of Park street and provide for sewers in the streets in which no sewers were shown by the plans approved for the Long Beach estates. The proposed sewers are to vary in size from 8 to 15 inches in diameter and are to be constructed with minimum slopes, due, presumably, to the flat nature of the land and the necessity for pumping. Owing to the comparatively flat slopes of these sewers it will be necessary to provide for systematic and regular inspection and cleaning of the sewers to guard against possible clogging. Flush tanks are to be installed at the upper ends of all lateral sewers and manholes are to be located at distances not more than 400 feet apart, which should facilitate the cleaning and inspection of the sewers.

The proposed sewers of the village south of Fulton street and east of Long Beach boulevard are to be tributary by gravity flow to the existing sewer in Park street. The sewers north of and including Fulton street and east of Riverside boulevard are designed to flow by gravity to a pumping station located at the intersection of Riverside boulevard and Water street. From this point the sewage is to be pumped into a proposed 15-inch sewer in Water street through which it will flow by gravity to a second pumping station located at the intersection of Hudson street and Magnolia boulevard. From this point this sewage together with the sewage from the section west of Center street and north of Hudson street will be pumped into a 15-inch sewer tributary to the existing 24-inch sewer in Park street.

Although the details of the proposed pumping stations are not shown, it appears from the plans and the application from the village authorities that each of these stations is to be equipped with two 6-inch centrifugal pumps having a capacity of 500 gallons per minute each and that these pumps are to be driven by 5 h. p. motors. The plans indicate that the sewage is to be discharged against a head of less than 10 feet.

From our examination of the plans it would appear that the proposed sewers if properly constructed and maintained should satisfactorily care for the sanitary sewage of the section of the village to be served by them, and that the sewage disposal plant, which was designed to care for a population of 5,000, is of adequate capacity to care for the additional population to be served by the proposed sewers.

I would, therefore, recommend that the plans be approved and a permit be issued allowing the discharge into Broad or Long Beach channels of the sewage to be collected by the proposed sewers after such sewage shall have been first passed through the existing disposal plant.

Respectfully submitted,
THEODORE HORTON,
Chief Engineer

ALBANY, N. Y., *May* 21, 1915

PERMIT

Application having been duly made to the State Commissioner of Health, as provided by section 77 of chapter 49 of the Laws of 1909, the "Public Health Law," as amended by chapter 553 of the Laws of 1911, constituting chapter 45 of the Consolidated Laws, permission is hereby given to board of trustees of the village of Long Beach to discharge sewage from the proposed sewer extension to the sewer system of the village into the waters of Broad or Long Beach channel through the outlet of the Long Beach sewage disposal works within the town of Hempstead in accordance with the plans accompanying the petition, under the following conditions:

1. That this permit shall be revocable at any time or subject to modification or change when in the judgment of the State Commissioner of Health such revocation, modification or change shall become necessary.
2. That the issuance of this permit shall not be deemed to affect in any way action by this Department on any future application that may be made for permission to discharge additional sewage or effluent into the waters of this State.
3. That only sanitary or domestic sewage, and no storm water or surface water from streets, roofs or other areas shall be admitted to the proposed sewers.
4. That all the sewage to be collected by the proposed sewers before it is discharged into Broad or Long Beach channel shall first be passed through the Long Beach sewage disposal plant.
5. That all necessary arrangements shall be made by the village of Long Beach with the Long Beach estates or other corporations controlling the Long Beach sewage disposal plant for proper treatment at all times of the sewage of the village of Long Beach in the Long Beach sewage disposal plant in accordance with the requirements of the permit issued to the Long Beach estates on March 15, 1910, or for the disposal

of the sewage of the village by some other satisfactory means of treatment in accordance with plans to be submitted to and approved by this Department.

6. That the proposed sewers shown by the plans approved this day shall be constructed in complete conformity with such plans or approved amendments thereof.

LINSLY R. WILLIAMS,
Deputy State Commissioner of Health

May 27, 1915

MALONE

HERMANN M. BIGGS, M. D., *State Commissioner of Health:*

Amended plans for a portion of the sewer system of the village of Malone were submitted to this Department for approval on April 30, 1914. An application asking for the approval of the plans and the issuance of a permit for the temporary discharge of sewage from the proposed sewers into the Salmon river was received from the board of trustees of the village on May 1, 1914.

A single copy of these plans was first submitted for approval by Porter & Short of Malone on April 19, 1914, asking for permission to temporarily discharge the sewage from the proposed sewer into the Salmon river until such time as the sewer system and sewage disposal works for the village, plans for which were approved by this Department on May 4, 1909, shall be installed. It was stated that the proposed sewer would relieve the insanitary conditions caused by the lack of sewage facilities in the so-called Junction Section of the village.

These plans were given preliminary examination by the engineering division and Messrs. Porter and Short were advised on April 24, 1914, that the following requirements of the Department must be met before consideration could be given to any plans for the proposed change:

1. As noted above, plans should be submitted in duplicate and the full data regarding design of each portion of each sewer should be shown, together with manholes indicated at all changes of slope and alignment of sewers.

2. Since the proposed change in the general plans for sewers for the village involves the conveyance of sewage from a considerable area to the point near the Paper Mill bridge at an elevation which would require pumping to deliver such sewage to the proposed sewage disposal works of the village, the plans should be revised as follows: Instead of carrying the proposed trunk or outlet sewer northerly on Constable street, as shown by the plans submitted, from a point near the northerly corporation line, this sewer should be shown passing through Fifth street to Park street and thence along Park street so that, in this manner, the considerable volume of flow in the sewer may, when the village sewer system is constructed, be diverted into the proposed June street sewer, which could at any time be constructed with a proper capacity to care for the additional flow of sewage over that provided for by the original plans. The proposed sewer should also be shown extending to the point along the road east of the Salmon river, say 200 feet northerly from the point of discharge near the Paper Mill bridge as shown by the plans presented.

3. Careful consideration should be given to the capacity of the proposed outfall sewer in order that when constructed it may be made a part of the permanent general system of sewers of the village.

4. The plans must be submitted by the village authorities and application for their approval made by the village authorities since the Public Health Law and Village Law contemplate that the authorities of the village shall be responsible for the public sewers in the village and this Department must necessarily hold the village responsible for proper treatment of sewage when required, making it necessary that the village should adopt and ratify any change in the general plans for sewers.

Under date of April 26, 1915, you were advised by Mr. N. W. Porter that it would be impracticable owing to the topography to construct a sewer along the route recommended by us but that it would be possible to construct a sewer with adequate slopes from the corner of Sprague and Marion streets through private property and reach Park street at a point where the surface elevation of the ground is 525. The invert elevation of the sewer provided for by the approved plans shows a sewer in Park street at this point having an invert elevation of 521. Mr. Porter was accordingly advised under date of April 27 that the approval of plans drawn up as suggested by him would be approved if submitted by the village authorities.

The plans now submitted were presented in duplicate and show that it is proposed to construct a 10-inch sewer from the corner of Marion and Sprague streets through private property in Constable street and in Park street discharging into Salmon river at a point about 200 feet below the Paper Mill bridge. The upper portion of this sewer from Sprague street to Constable street is to have a slope of .5 per cent. Although the slope of the proposed sewer between Constable street and Park street is not shown, it is found that an average slope of nearly 2.0 per cent. may be obtained between these two points. Manholes are to be placed at all points of change of slope and alignment. There is, however, a 1,200-foot section of sewer above Park street with no intermediate manhole. Additional manholes should be placed on this long line above Park street.

It is found from our examination of the plans that it is not proposed to modify in any way the plans for the lateral sewers in the so-called Junction Section of the village, and that, provided the invert elevation of the proposed sewer where it enters Park street is not more than five feet below the ground, the sewer may be carried across the river from this point to a manhole having an invert elevation of 508.8, from which point a gravity flow to the disposal plant may be obtained. The sewer may also be carried across the river at a point near the Paper Mill bridge as provided for by the approved plans. If the latter alternative should be adopted the sewage from the Junction Section would require pumping. It would therefore be advisable to keep the sewer sufficiently high in Park street to permit of carrying the sewage across the river to the disposal plant by gravity.

In view of the above I would recommend that the plans be approved and a permit be issued allowing the temporary discharge of sewage from the proposed sewer into the Salmon river at a point 200 feet below the Paper Mill bridge. I would further recommend that the permit contain in addition to the usual revocation and modification clauses the following conditions:

1. That an intermediate manhole should be installed on the long section of sewer above Park street.
2. That the invert elevation of the proposed sewer where it enters Park street shall not be lower than 520.0.
3. That the slope of the proposed sewer below Constable street shall not be less than 0.5 per cent.

Respectfully submitted,

THEODORE HORTON,
Chief Engineer

ALBANY, N. Y., *April* 3, 1915

PERMIT

Application having been duly made to the State Commissioner of Health, as provided by section 77 of chapter 49 of the Laws of 1909, the "Public Health Law," as amended by chapter 553 of the Laws of 1911, constituting chapter 45 of the Consolidated Laws, permission is hereby given to the board of trustees of the village of Malone to discharge sewage from the sewers shown by the amended plans for sewerage for a portion of the village approved this day into the waters of Salmon river at a point 200 feet below the Paper Mill bridge within the town of Malone in accordance with the plans accompanying the petition, under the following conditions:

1. That this permit shall be revocable at any time or subject to modification or change when in the judgment of the State Commissioner of Health such revocation, modification or change shall become necessary.

2. That the issuance of this permit shall not be deemed to affect in any way action by this Department on any future application that may be made for permission to discharge additional sewage or effluent into the waters of this State.

3. That only sanitary or domestic sewage and no storm water or surface water from streets, roofs or other areas shall be admitted to the proposed sewers.

4. That an intermediate manhole shall be installed on the long section of sewer above Park street.

5. That the invert elevation of the proposed sewer where it enters Park street shall not be lower than 520.

6. That the slope of the proposed sewer below Constable street shall not be less than 0.5 in any section.

7. That whenever required by the State Commissioner of Health the sewage disposal works shown on the plans approved by this Department or approved amendments thereof shall be constructed and the sewage to be collected by the proposed sewers shall be conducted to such sewage disposal works for treatment.

LINSLY R. WILLIAMS,
Deputy State Commissioner of Health

May 3, 1915

MEDINA

In the Matter of the Certification of the Board of Health of the Village of Medina, Orleans county, recommending the construction of additional sewers.

WHEREAS, The board of health of the village of Medina, acting under the provisions of section 21-a of the Public Health Law, have deemed the sewers of the village of Medina insufficient to properly and safely sewer said village, and have certified this fact to me in writing stating and recommending, with the reasons therefor, the construction of a sewer along Worthy avenue from Meade avenue westerly to State street; and

WHEREAS, Such recommendations and the reasons therefor, for the construction of said sewers and appurtenances, have been carefully considered and meet with my approval.

NOW, THEREFORE, I, Linsly R. Williams, Deputy State Commissioner of Health, acting under the authority vested in me by section 21-a of the Public Health Law, as amended by chapter 559 of the Laws of 1913, do hereby approve said recommendations this 30th day of June, 1915.

LINSLY R. WILLIAMS,
Deputy State Commissioner of Health

ALBANY, N. Y.

HERMANN M. BIGGS, M.D., *State Commissioner of Health:*

Plans for proposed sewer extensions in the village of Medina, Orleans county, were submitted to this Department for approval by the board of sewer commissioners of the village on September 27, 1915.

The records of the Department show that original plans for the sewer system of the village of Medina were approved by the then State Board of Health on April 9, 1890. Plans for extensions and alterations to this system have been approved from time to time since that date. The permits issued in connection with the approval of all plans on and since May 21, 1914, contain in addition to the usual revocation and modification clauses the condition that on or before February 1, 1915, the village of Medina shall submit for approval satisfactory detailed plans showing works for the partial treatment by sedimentation or clarification of the entire sanitary sewage

of the village together with general plans for more complete treatment of such sewage. The reasons for imposing this requirement were fully discussed in the report on the examination of plans for sewers in Park avenue and other streets under date of May 7, 1914, and will therefore, not be reviewed at this time.

Under date of June 25, 1915, the village board made application under section 21-a of the Public Health Law asking for permission to construct a sewer in Worthy avenue from Meade avenue westerly to State street in the village of Medina on the grounds that the sewers of the village were deemed insufficient to properly and safely sewer said village and protect the public health thereof. This application was accordingly granted on June 30, 1915. The attention of the village authorities was at that time called to the necessity of submitting plans for the proposed sewer to this Department for approval before the sewer was constructed.

The plans now presented have been submitted in accordance with the above request and show that it is proposed to construct an 8-inch sewer in Meade avenue between Elizabeth street and Elmwood avenue and in Worthy avenue between Meade avenue and State street, discharging into the State street sewer at Worthy avenue. The State street sewer empties into Oak Orchard creek through the main outfall sewer of the village below Sweets dam in the town of Ridgeway.

The proposed sewers are to have a total length of about 1,760 feet and are to be constructed with a slope of .88 per cent. Manholes are to be constructed at the upper ends of the sewer and an intermediate manhole is to be constructed on the Worthy avenue sewer midway between State street and Meade avenue. The proposed sewers if properly constructed should satisfactorily care for the sanitary sewage of the section to be served by them.

In conclusion I would state that although the conditions of the permit issued last year with respect to the submission of plans for sewage disposal have not been complied with, it would appear from the petition made by the village on June 25, 1915, under section 21-a of the Public Health Law, that the proposed sewers are necessary to properly and safely sewer and to protect the public health of the village. I would, therefore, recommend that the plans be approved and a permit issued allowing the discharge of sewage from the proposed sewer into Oak Orchard creek below Sweets dam in the town of Ridgeway.

Respectfully submitted,

THEODORE HORTON,

Chief Engineer

Albany, N. Y., *October* 4, 1915

Permit

Application having been duly made to the State Commissioner of Health, as provided by section 77 of chapter 49 of the Laws of 1909, the "Public Health Law," as amended by chapter 553 of the Laws of 1911, constituting chapter 45 of the Consolidated Laws, permission is hereby given to the board of sewer commissioners of the village of Medina to discharge sewage from the proposed sewer extensions in Worthy and Meade avenues into the waters of Oak Orchard creek below Sweets dam within the town of Ridgeway in accordance with the plans accompanying the petition, under the following conditions:

1. That this permit shall be revocable at any time or subject to modification or change when in the judgment of the State Commissioner of Health such revocation, modification or change shall become necessary.
2. That the issuance of this permit shall not be deemed to affect in any way action by this Department on any future application that may be made for permission to discharge additional sewage or effluent into the waters of this State.
3. That only sanitary or domestic sewage and no storm water or surface water from streets, roofs or other areas shall be admitted to the proposed sewers.

LINSLY R. WILLIAMS,

Deputy State Commissioner of Health

October 13, 1915

MIDDLETOWN

HERMANN M. BIGGS, M.D., *State Commissioner of Health:*

Plans for outfall sewers and sewage disposal works for the city of Middletown, Orange county, were submitted to this Department for approval by the mayor of the city on April 20, 1914.

General description

The records of the Department show that sewers discharging directly into Monhagen brook within the city limits were constructed as early as 1881, and although the sewer system has been extended from time to time since that year no plans were submitted to or approved by this Department until 1913, when plans for the east side trunk sewer were presented and approved. The sewage from practically all of the present population of some 17,000 persons is now discharged directly into Monhagen brook without treatment.

The discharge of sewage from the city of Middletown with reference to its effect on Monhagen brook and the Wallkill river, of which Monhagen brook is a tributary, has been brought to the attention of the Department by riparian owners from time to time during the last few years and has been a subject of investigation on a number of occasions. As a result of investigations made in 1891, 1894, 1906, 1908 and 1911 it was recommended that the sewage of the city of Middletown receive treatment in properly designed and adequate sewage disposal works before its discharge into Monhagen brook. The necessity of such treatment of the sewage was further brought out in an investigation made in 1912 of the condition of pollution of the Wallkill river.

Following the investigation and report of the pollution of the Wallkill river under date of September 30, 1912, the mayor and common council of the city of Middletown were asked on October 7, 1912, for definite advices or assurances as to what steps the city proposed to take in the matter of providing suitable sewage disposal works for the proper treatment and disposal of its sewage. At that time the seriousness of existing conditions respecting sewage pollution of the Wallkill river and Monhagen brook and the necessity of proper treatment of the sewage of the city was pointed out to the city authorities. Soon after advices were received from the city authorities stating that the city had begun an investigation as to the proper plant to be installed to care for the sewage of the city discharging into Monhagen brook.

On May 22, 1913, plans for a proposed east side trunk sewer were approved and a permit issued containing as one of the conditions the provision that on or before December 1, 1913, plans for intercepting and outfall sewers and for sewage disposal works for the city should be submitted to this Department for approval. Plans for main outfall sewers and sewage disposal works were not submitted for approval, however, until April 20, 1914, and since an application for the approval of the plans submitted and the issuance of a permit was not submitted in full compliance with the requirements of the Department as presented in section 77 of the Public Health Law, the examination of the plans was held in abeyance until you directed me recently to proceed with their examination irrespective of these requirements.

The plans now presented were prepared by George A. Johnson of the firm of Johnson & Fuller, consulting engineers of New York city, and comprise tracings and blue prints of the following sheets:

1. A general plan of disposal works
2. General plan of main outfall sewer
3. Grit chamber and inlet to settling tanks
4. Plan of settling tanks
5. Siphon and settling tanks
6. Plan of sprinkling filter
7. Details of sprinkling filters.
8. Sludge drying bed.

Duplicate copies of reports and specifications and additional copies of plans, specifications and reports to be submitted to the Conservation Commission were also received.

The report of the designing engineer states that the average flow of sewage from the present population of 17,000 persons is equal to about 4,300,000 gallons a day and that the disposal plant has been designed to care for a daily flow of 6,000,000. The daily per capita rate of sewage contribution is 250 gallons, so that on this basis the disposal works should care for a future population of 24,000 persons. The designing engineer estimates that a population of 22,500 persons will be reached within the next 15 years. It appears from the report of the engineer that the wastes from a tannery which are now discharged directly into Monhagen brook will be admitted to the sewers after the construction of the disposal works and it is recommended that before the discharge of these wastes into the city sewer provisions be made for the removal of the hair and other substances in the wastes which would tend to clog the sewers and interfere with the proper operation of the disposal plant. The report of the designing engineer also states that the sewage is at present discharged into Monhagen brook at three points, namely, through two sanitary sewers near the southerly corporation line and during times of storm through a large combined sewer within the built-up sections of the city. It is stated that the dry weather flow of the combined sewer is discharged through an opening in its invert into a sanitary sewer below so that only in times of surface runoff does the sewage enter the brook at the outlet of the combined sewers.

From a preliminary examination of the plans for sewage disposal in November of this year it was found that whereas the proposed disposal works as shown by the plans had in general been designed to meet local requirements for sewage disposal there were not sufficient data with reference to the existing sewer system of the city either on file in this Department or submitted with the plans to permit of their full and complete examination, especially with reference to the important question of separation and interception of the sanitary sewage of the city as required in the permit issued on May 22, 1913, above referred to.

You accordingly addressed a letter to the mayor of the city on November 17, 1914, in which you called his attention to the conditions of the permit for sewage discharge granted to the city authorities on May 22, 1913, in connection with the approval of the plans for the east side trunk sewer and quoting from that part of the permit requiring that satisfactory detailed plans for intercepting and outfall sewers to convey the entire sanitary sewage of the city of Middletown to a suitable site for disposal works be submitted for approval, you pointed out that the plans as submitted on April 20, 1914, did not include plans for intercepting sewers to convey the entire sanitary sewage of the city to the sewage disposal works, nor any plans for intercepting the dry weather flow of sewage of the present combined sewers. It is also pointed out that plans showing the separation of the sanitary sewage from the storm or surface water should be submitted even though it might not be necessary at this time to provide for a complete separation of the sanitary sewage from the storm water in the districts served by the combined sewer.

On December 11 duplicate copies of the general sewer map of the city of Middletown, drawn to a scale of 400 feet to an inch, were submitted. This map shows in a general way the present sewer system of the city. Separate sewers are shown on this map by black lines and combined sewers by red lines, and although the sizes of the sewers are shown, the grades, elevations and slopes of the sewers are not indicated nor is the proposed method of providing for the separation of the sanitary sewage from the storm or surface water and for the conveyance of the entire sanitary sewage of the city to the sewage disposal works shown.

A detailed plan of the intercepting manholes proposed or at present in use on Fulton street to divert to the Fulton street sewer at three points the dry weather flow in the combined sewers at Harding, Canal and Oak streets is shown by the plans, but this detailed plan shows simply an opening

in the combined sewers referred to by the consulting engineer through which the dry weather flow of sewage is to pass into the Fulton street sewer leading to the disposal plant and provides for no means of regulating the volume of flow to be diverted to the Fulton street sewer in wet weather.

The problem of the disposal of sewage at Middletown is an important one and the question of how to best provide against the present and future pollution of Monhagen brook and Wallkill river should at this time, when plans for sewage disposal are before the Department for approval, be given the most careful consideration and I believe that unless steps are taken to provide for an ultimate separation of the sanitary sewage from storm water or surface water the benefits of the installation of the proposed sewage plant will be only partial and that following times of storm, especially at certain seasons of the year, serious nuisances will continue to arise, owing to the small volume of the flow of the brook which at certain times, is not appreciably greater than the present flow of sewage. The seriousness of any nuisance created by the overflow of combined sewers in Monhagen brook will also increase as the population tributary to the city sewer system increases. I am of the opinion, therefore, that no more combined sewers should be constructed in the city and that plans for the future elimination of the discharge or overflow from the combined sewers and the complete separation of the storm water from the sanitary sewage should be submitted to this department for approval at an early date.

Outfall sewers

From our examination of the plans for outfall sewers and sewage disposal works now before the department it appears that it is proposed to connect the two existing outfall sewers near the southerly corporation line by means of an 18-inch vitrified tile pipe sewer, utilizing the existing manholes. Beyond this point it is proposed to construct a 27-inch sewer leading to the disposal plant some 4,000 feet below the city.

The proposed sewer is to be constructed of either tile pipe or segment block pipe and is to be laid on a uniform slope of .33 per cent. The sewer, therefore, if properly constructed should have a capacity of about 12 million gallons per day and should be adequate as to capacity to care for the probable ultimate flow of sanitary sewage of the city within the life of the system.

Disposal plant site

It is proposed to treat the sewage collected by this sewer in a sewage disposal plant consisting of a screen chamber, settling tanks, sprinkling filters and sludge drying beds located on the east bank of Monhagen brook about 4,000 feet south of the city boundary line. The sewage disposal plant site is at a considerable distance from any developed portions of the city and the general plan of the disposal plant indicates that the nearest highway is some 500 feet away. Monhagen brook at this point has a drainage area of approximately 10 square miles and drains the city of Middletown through which it flows.

Grit and screen chamber

Upon reaching the disposal plant the sewage enters a grit and screen chamber divided into two compartments, each 3 feet by 100 feet in plan and 1½ feet deep below the flow line. The chamber is provided with stop planks at inlet and outlet so that each or both compartments may be operated at one time. Near the inlet end of each compartment is to be placed an inclined bar screen consisting of ⅜-inch by 2-inch iron bars spaced 2 inches in the clear and so arranged that the screens may be conveniently cleaned by raking. The sewage will have a velocity of about 1 foot per second through the grit chamber when both compartments are in use and a capacity of about 11 cubic yards of detritus has been provided for by depressing the bottom of the chamber 1 foot. It is to be drained by means of a channel 10 inches wide placed longitudinally in the bottom of the central portion of each compartment. Each of these channels is to contain an underdrain surrounded by

gravel and broken stone and covered by slotted vitrified flat tiles laid flush with the bottom of the chamber. The underdrains are to discharge into the underdrains of the sludge drying beds and thence into the filter gallery.

Settling tanks

The sewage upon leaving the grit chamber is to flow directly into the distributing channel of the settling tanks which are to be horizontal flow tanks of the Imhoff type built in five units, each unit having two parallel settling compartments and two sludge digesting chambers. The settling tanks are so arranged that the sewage may be introduced to them from either end thereby providing for a reversal of the flow of the sewage through the tanks and diverting plates are to be provided to give a uniform flow through the tanks.

The settling tanks are planned with a total settling capacity of about 250,000 gallons, equal to about 1½ hours flow of sewage under present conditions and with a future flow of six million gallons, and a time of detention of about 1 hour will be obtained.

The sludge compartments located below the settling compartments have a combined capacity of about 19,000 cubic feet which should be adequate to provide a storage period of about 7 months for the sludge deposited by sewage contributed by the present population of 17,000 persons. It is planned to remove the sludge from the sludge compartments and discharge it by gravity flow to adjacent sludge beds by means of 8-inch cast iron pipes which extend to a point near the apex of each sludge hopper. The sludge compartments are also to be provided with rings of 1½-inch lead perforated water-pipes to facilitate the removal of the sludge.

Slugde beds

The sludge drying bed area is to be divided into six sections each of which is to be 14 feet wide by 70 feet long, thereby providing for about 350 square feet of sludge drying area per thousand persons served under present conditions. The sludge beds are to be filled to a depth of from 15 to 18 inches with graded gravel overlaid with sand and an underdrain discharging into the filter gallery of the sprinkling filter is to be placed along the center line or longitudinally under the center of each bed.

Dosing tank

From the settling tank the clarified effluent is to be discharged through a 30-inch vitrified tile pipe to a hopper-shaped dosing tank provided with a 30-inch discharge siphon which is planned to discharge intermittently into the main distributing pipe of the sprinkling filter. The hydrostatic head or difference of elevation between the maximum elevation of the discharge level of the dosing tank and the sprinkling nozzles under which the siphon will operate is 6 feet, with a minimum head of 1½ feet. According to data compiled by the Pacific Flush-tank Company a 30-inch discharge siphon operated in connection with sprinkling filters under a maximum head on the nozzles of 7 feet with a minimum head of 2 feet will care for a flow of only some 2 million gallons per 24 hours, and with an available maximum head on the nozzles of 9 feet and a minimum head of 2½ feet, a 30-inch siphon will care for only 4 million gallons per day. It appears, therefore, that the proposed siphon operating under heads varying from 6 to 1½ feet would not be adequate as to capacity to provide for an intermittent discharge of effluent to the sprinkling filter with a flow of from 4 million to 6 million gallons per day for which the disposal plant is designed. I am of the opinion that a larger siphon if objectionable should be provided or that additional dosing tanks should be installed. It appears also that the operating head at the disposal plant could be increased considerably by increasing the size of the main trunk sewer leading to the plant from 27 inches to 30 inches in diameter and at the same time decreasing the slope of the sewer to correspond to the increased size of pipe.

Sprinkling filter

The proposed sprinkling filter which is to be trapezoidal in plan is to have a total area of 1½ acres and is to be divided into two equal parts by means of an operating gallery containing the main distributing or supply pipe and the effluent channels. The filter is to be filled to an average depth of 5.75 feet with broken stone ranging from 1 inch to 2½ inches in size.

The distributing system of the filter is to consist of a main distributor or supply pipe ranging in size from 30 inches to 16 inches in diameter, 6 inch laterals spaced 11 feet apart, 3-inch riser pipes with square spray nozzles spaced 11 feet apart center to center. The lateral distributors are to be provided with valves and are to be supported with concrete piers so that the center lines of the pipes will be 16 inches below the surface of the stone in the filter.

The underdrain system is to consist of channels in the floor of the filter covered with allotted vitrified flat tiles. The channels are to be 6 inches deep and will have a slope of .5 per cent. toward the filter gallery. A 1-inch wrought-iron flush pipe is to be installed at the upper end of each collecting chamber. The effluent collected by the underdrain system is to be discharged into a gutter located on each side of the filter gallery and then through a 30-inch vitrified tile pipe directly into Monhagen brook. Although the elevation of the stream at the point of discharge is not shown by the plans it appears from the report of the designing engineer that the elevation of the ordinary high water of the brook will be about 1½ feet below the bottom of the filter so that the operation of the plant will probably not be interfered with except during extraordinary high water conditions.

As noted above the filter will have a total effective area of 1½ acres and will therefore be required to operate at a rate of from 2,800,000 gallons to 4,000,000 gallons per acre per day when treating sewage varying in volume from the present flow of about 4,300,000 gallons to a future flow of 6,000,000 gallons respectively. On the basis of a per capita rate of sewage contribution of 100 gallons per day the rate of operation would be 1,130,000 gallons and 1,500,000 gallons per acre per day when serving 17,000 and 22,500 persons respectively. It would appear, therefore, that the proposed rate of operation is not excessive for a filter of the depth shown.

It is proposed to discharge the effluent from the filter directly into Monhagen brook without any further treatment. It is usual, however, to pass the effluent from sprinkling filters through short detention settling tanks in order to settle out the coarser suspended solids which peel off from the filtering material of filters of this type. Although the sludge derived from final settling tanks treating sprinkling filter effluent is usually of a more stable character than sludge from preliminary settling tanks it nevertheless creates objectionable conditions at times. I am of the opinion, therefore, that owing to the small size of Monhagen brook and the nature of the territory through which it flows a final settling tank should be installed to treat the effluent from the proposed sprinkling filters if it is found upon operation that any objectionable conditions are created owing to the discharge of unsettled sprinkling filter effluent into the brook.

Conclusions and recommendations

In conclusion I would state that it appears from our examination of the plans that the proposed sewage disposal works if modified in certain respects as noted above and provided they are properly constructed and operated should satisfactorily care for the sanitary sewage of the city and produce an effluent which may safely be discharged into Monhagen brook without objection at this time. Provision should be made, however, for the ultimate separation of the sanitary sewage from storm or surface water.

I would therefore recommend that the plans for sewage disposal be approved and a permit be issued allowing the discharge of effluent from the proposed sewage disposal plant into Monhagen brook in the town of Wawayanda. I

would further recommend that the permit contain in addition to the usual revocation and modification clauses the following conditions:

1. That within one year plans for the complete separation of the entire sanitary sewage of the city from the storm or surface water be submitted to this Department for approval and that after the approval of said plans any or all portions of the sanitary sewers necessary to separate the sanitary sewage from the storm water shall be constructed when required by the State Commissioner of Health.

2. That whenever required by the State Commissioner of Health satisfactory detailed plans for secondary settling tanks for the treatment of the effluent from the sprinkling filter shall be submitted; that such tanks be constructed and put in operation within such time limit as may be then specified.

3. That suitable arrangements be made or adequate dosing devices installed to provide for intermittent discharge in a proper manner of the settling tank effluent to the sprinkling filters.

Respectfully submitted,

THEODORE HORTON,
Chief Engineer

ALBANY, N. Y., *December* 31, 1914

PERMIT

Application having been duly made to the State Commissioner of Health, as provided by section 77 of chapter 49 of the Laws of 1909, the "Public Health Law," as amended by chapter 553 of the Laws of 1911, constituting chapter 45 of the Consolidated Laws, permission is hereby given to the common council of the city of Middletown to discharge effluent from the proposed sewage disposal works for the city of Middletown into the waters of Monhagen brook at that point of discharge shown by the plan within the town of Wawayanda in accordance with the plans accompanying the petition, under the following conditions:

1. That this permit shall be revocable at any time or subject to modification or change when in the judgment of the State Commissioner of Health such revocation, modification or change shall become necessary.

2. That the issuance of this permit shall not be deemed to affect in any way action by this Department on any future application that may be made for permission to discharge additional sewage or effluent into the waters of this State.

3. That both the sewers and the sewage disposal works shown by plans approved this day shall be fully constructed in complete conformity with such plans or approved amendments thereof.

4. That no sewer sludge from any part of the disposal works shall be discharged in Monhagen brook or any other watercourse.

5. That on or before January 1, 1916, satisfactory plans for sanitary sewers which will provide for the complete separation of the entire sanitary sewage of the city from storm or surface water shall be submitted to this Department for approval; and that after the approval of said plans any or all portions of such sanitary sewers shall be constructed when required by the State Commissioner of Health.

6. That whenever required by the State Commissioner of Health satisfactory detailed plans for secondary settling tanks for the treatment of the effluent from the sprinkling filter shall be submitted for approval; and that such tanks shall be constructed and put in operation within such time limit as may be specified.

LINSLY R. WILLIAMS,
Deputy State Commissioner of Health

January 5, 1915

MINOA (High school)

HERMANN M. BIGGS, M.D., *State Commissioner of Health:*

Plans for sewage disposal for a new high school building in the village of Minoa, Onondaga county, were submitted to this department for approval on May 3, 1915.

The plans were prepared by Mr. George E. Higgins, civil engineer, of Syracuse, and comprise tracings and blue prints of the following:

1. General plans showing school house, sewage disposal plant, and Butternut creek.
2. Details of settling tank, dosing chamber, subsurface irrigation system, and sludge bed.
3. Cross sections through different portions of the disposal system.

According to the report of the designing engineer, it appears that the high school building has a maximum seating capacity of 250 pupils. The water consumption is estimated at 10 gallons per capita, which appears to be a reasonable allowance. The school is located about 250 feet from Butternut creek and, according to the report of the engineer, the soil is of a sandy, gravelly nature. It is proposed to treat the sewage from the school in a disposal plant consisting of a settling tank, siphon chamber, subsurface irrigation field, and sludge bed. The sewer leading from the school to the disposal plant is to consist of some 230 feet of 8-inch vitrified tile pipe laid with a slope of .5 per cent.

The proposed settling tank, which is to be a single compartment tank, is to be covered and is to be provided with a baffle board near the inlet and one near the outlet. It is to be 13 feet long, 6 feet wide by 6 feet deep, inside dimensions, and will have sufficient capacity to give an average time of detention of the sewage of a little over one day on the basis of design used. The effluent from the settling tank is to flow over a weir into an adjacent dosing chamber provided with an automatic discharge siphon by means of which the settled sewage is to be discharged intermittently into a proposed subsurface irrigation system.

This system is to consist of the main 6-inch distributor from which is to extend four lines of 4-inch tile laid with open joints at a depth of 18 inches below the surface of the ground. These lines are to be spaced 6 feet apart and are to be laid on a slope of 1/16 of an inch to a foot. Each of the four lines of distributors is to be 250 feet long, making a total of 1,000 feet of distributing tile. The entire system covers an area of about 1/7 acre and on the basis of design used would be required to operate at the rate of about 18,000 gallons per acre per day.

The upper 150 feet of each of the four lines of distributors, however, are shown with solid lines and the lower portion with dotted lines, which would indicate that it is proposed to construct only four lines 150 feet long each at this time. In subsurface irrigation fields treating domestic sewage, it is usual to provide from 25 to 50 feet of tiling per person when the field is to be constructed in porous soil. Owing, however, to the lower per capita rate of water consumption, the absence of grease, and the small organic content of the sewage from school houses, it is not necessary to provide so many feet of tiling per person for schoolhouse sewage as would be necessary for ordinary domestic sewage. The entire subsurface irrigation system shown by the plans, amounting to four lines 250 feet long each, should, however, be constructed at this time and, unless the soil is very porous, it is probable that it will be necessary to extend this system in the near future. The proposed settling tank should, therefore, be constructed some 20 or 30 feet nearer to the school house in order to permit of constructing additional lines of tile without having any line nearer the stream than those shown by the plans, should such extension of the system be necessary in the future.

The subsurface irrigation field should also be divided into two sections in order to permit of operating the two portions of the field on alternate days or alternate weeks as may be desired. This could be done by constructing a two-way gate at the junction of the 6-inch line leading from the dosing tank

to the main distributor at the head of the lateral system. Care should also be taken to protect the lateral distributors from infiltration of sand and the consequent clogging of the system by surrounding the lines with graded gravel and by covering each joint with tar paper, terra cotta cap, or other suitable means.

The plans show that it is proposed to remove the sludge from the settling tank through a sludge pipe and discharge it to a sludge bed 16 feet square and 1½ feet deep. According to the plans the soil at the sludge bed is a sandy gravel, and should, therefore, provide for proper drainage for the sludge.

From our careful examination of the plans, it appears that the proposed sewage disposal plant, if properly constructed and if maintained with care and efficiency, should satisfactorily care for the sewage from the school house. I would, therefore, recommend that the plans be approved on condition that the plant be so constructed as to permit of extending the subsurface irrigation system and that this system be so arranged as to permit of operating different portions of the system alternately.

Respectfully submitted,

THEODORE HORTON,
Chief Engineer

Albany, N. Y., *May* 10, 1915

The plans were approved on May 17, 1915, in accordance with the above recommendation.

MOHANSIC STATE HOSPITAL

Albany, N. Y., *September* 27, 1915.

Hon. Lewis F. Pilcher,
State Architect,
Albany, N. Y.

Dear Sir.— On September 3, 1915, you submitted to this Department plans for sewerage and sewage disposal works for the Mohansic State Hospital at Yorktown Heights, N. Y. These plans show that the works will consist of:

1. A set of Imhoff tanks, for sedimentation with a capacity of 3 hours' flow of sewage allowing 150 gallons per capita.
2. Sand filter beds, for filtration of an area sufficient for the passage of 50,000 gallons per acre per day, based on a daily flow of 100 gallons per capita.
3. Terminal disinfection with liquid chlorine.

They provide that the effluent from this plant shall be discharged beneath the surface of the waters of Crom pond.

The system proposed will, in my judgment, furnish adequate provision for sedimentation and sand filtration and terminal chlorination, and is in accordance with the recommendations made by the Commission, referred to in my letter to you of July 27, 1915, in regard to the New York State Training School for Boys.

I return the plans to you with certain conditions as stated below, reaffirming in general the position taken by this Department when the plans for the sewage disposal works at Yorktown Heights were approved by this Department on July 27, 1915. The approval of the plans is therefore granted subject to the following conditions:

1. That the approval of these plans is considered to be temporary only, and that it contemplates eventually the conveyance of the effluent from the proposed sewage disposal works to a point outside the limits of these watersheds.
2. That the approval of these plans shall be limited to a period of one year from the date when the sewage disposal works are first placed in operation unless such time limit is extended by the State Commissioner of Health.

3. That the approval of these plans shall be revocable at any time or subject to modification or change when, in the judgment of the State Commissioner of Health, such revocation, modification or change may be necessary.

4. That the approval of these plans shall not be deemed to affect in any way action by this Department on any future application that may be made for permission to discharge additional sewage or effluent into the waters of this State.

5. That both the sewer system and the sewage disposal works shown by plans approved this day shall be fully constructed in complete conformity with such plans or approved amendments thereof.

6. That only sanitary or domestic sewage, and no storm water or surface water from roads, grounds, roofs or other areas shall be admitted to the proposed sewers.

7. That no sewage sludge from any part of the disposal works shall be discharged into Mohansic lake, Crom pond or any watercourse or body of water.

8. That the installation and subsequent operation of the plans shall be at all times satisfactory to this Department.

9. That regular reports of the operation of the plant shall be submitted to this Department in such form and at such times as may be required.

10. That at all times the sand filters shall have an area of one acre to 500 population and that the effluent from the sand filters shall be properly disinfected at all times by chlorination, using not less than 5 parts of available chlorine per million parts of sewage.

11. That whenever required the discharge of effluent from the works into Crom pond shall be discontinued and such outlet pipe and other works as may be necessary shall be constructed to properly convey the effluent from the works to some other point, and when required outside the Croton watershed, subject to appropriations made by the Legislature for this purpose.

Yours very truly,

HERMANN M. BIGGS,
Commissioner of Health

LINSLY R. WILLIAMS,
Deputy Commissioner of Health

MONROE COUNTY TUBERCULOSIS HOSPITAL

HERMANN M. BIGGS, M.D., *State Commissioner of Health:*

Amended plans for sewage disposal for the Monroe County Tuberculosis Hospital, known as the Iola Sanatorium, were submitted to this Department for approval on October 4, 1915.

The records of the Department show that plans for a sewage disposal plant consisting of a settling tank of the Imhoff type, a dosing tank, three intermittent sand filters and an auxiliary sludge bed for the disposal of sludge were approved by this Department on March 1, 1910. This plant was designed to care for a population of 100 persons and a sewage contribution of 10,000 gallons per day. It appears that the population at the hospital has increased considerably within the last few years and that there are at present some 200 persons at the hospital, including patients and help.

The plans now under consideration were first submitted for approval on August 20, 1915, and provided for the enlargement of the existing settling tank and sand filters to care for an ultimate future population of 500 persons. From our preliminary examination of these plans it was found that the settling tank as enlarged would not be of adequate capacity to satisfactorily care for a population of 500 people, for which it was intended, and the

plans were accordingly returned to the designing engineer with the recommendation that a new plant be constructed to care for the excess population over, say, 100 or 150 persons.

Plans revised in accordance with this recommendation were resubmitted for approval on October 4, 1915, and show that it is proposed to construct a new settling tank of the Imhoff type and to enlarge the existing dosing tank and sand filters.

It is planned to intercept a portion of the flow of sewage from the main sewer leading to the existing settling tank above this tank and divert this sewage to the proposed tank. The means for diverting a proportionate flow of sewage is not clearly shown by the plans, but the inlet to the new settling tank is to be provided with a valve which will in all probability make it possible to control the flow to the new tank.

The proposed settling tank, which is of the Imhoff type, is divided by means of reinforced concrete partitions into two upper settling compartments and two lower sludge compartments for the storage and the digesting of the sludge. The settling compartment has a capacity of about 4,000 gallons. The capacity of the existing tank is about 3,800 gallons. The two tanks will therefore give a detention period of the sewage of about 3¾ hours when serving a population of 500 persons and assuming a per capita rate of sewage contribution of 100 gallons per day.

The combined sludge storage capacity of the two tanks is over 500 cubic feet and should be adequate to care for the sludge for a population of 500. The sludge from the new tank is to be discharged by gravity flow under a head of about nine feet to the existing sludge drying bed, which has an area of 450 square feet. Perforated lead pipe connecting with the water supply system is to be provided in each sludge hopper in order to facilitate the removal of sludge.

The existing dosing chamber, which is provided with three 6-inch alternating siphons, is to be enlarged and will have a capacity of 352 cubic feet, which will be sufficient to flood one of the new sand filters to a depth of about one-half inch at each discharge of one of the siphons.

The sand filters have been enlarged in area from .1 acre to .55 acre and will therefore provide for a rate of operation of about 90,000 gallons per acre per day. The old filter beds, according to the report of the designing engineer, are to be thoroughly cleaned and all drains relaid.

No data are submitted as to the effective size of the sand nor are sufficient elevations shown to determine definitely the depth of the sand filters. The sand should have an effective size of not less than .2 mm. and the depth of sand comprising the filtering material of the sand filters should not be less than three feet.

In conclusion I would state that it appears from our examination of plans that the proposed sewage disposal plant, if properly constructed in accordance with the plans and above recommendations, should satisfactorily care for the sanitary sewage from a population of 500.

I would therefore recommend that the plans be approved and a permit be issued allowing the discharge of effluent from the proposed sewage disposal plant into a tributary of Allen creek within the town of Brighton on condition that the effective size of the sand shall be not less than .2 mm. and that the depth of the sand on the sand filters shall be not less than three feet.

Respectfully submitted,

THEODORE HORTON,
Chief Engineer

ALBANY, N. Y., *October* 6, 1915

PERMIT

Application having been duly made to the State Commissioner of Health, as provided by section 76 of chapter 49 of the Laws of 1909, the "Public Health Law," as amended by chapter 553 of the Laws of 1911, constituting chapter 45 of the Consolidated Laws, permission is hereby given to the commissioners of public buildings of Monroe county to discharge effluent from the sewage disposal works to be reconstructed in accordance with plans

approved this day into the waters of a tributary of Allen creek at the point of discharge shown by the plans within the town of Brighton in accordance with the plans accompanying the petition, under the following conditions:

1. That this permit shall be revocable at any time or subject to modification or change when in the judgment of the State Commissioner of Health such revocation, modification or change shall become necessary.
2. That the issuance of this permit shall not be deemed to affect in any way action by this Department on any future application that may be made for permission to discharge additional sewage or effluent into the waters of this State.
3. That the sewage disposal works shown by plans approved this day shall be fully constructed in complete conformity with such plans or approved amendments thereof.
4. That only sanitary or domestic sewage and no storm water or surface water from grounds, roofs or other areas shall be admitted to the sewage disposal works.
5. That no sewage sludge from any part of the disposal works shall be discharged into Allen creek or any other watercourse.
6. That the effective size of the sand to be used in forming the filters shall not be less than 0.20 mm. and that the depth of sand on the sand filter shall be not less than three feet.

LINSLY R. WILLIAMS,
Deputy State Commissioner of Health

October 13, 1915

MT. KISCO

HERMANN M. BIGGS, M.D., *State Commissioner of Health:*

Amendments to the sewer system for the village of Mt. Kisco were presented for approval on May 17 by President Banks of the village, these plans having been prepared by Mr. F. B. Darling, village engineer. The original plans under which the sewer system of the village was constructed were approved on October 24, 1907, an arrangement having been made between the village and the city of New York whereby the city met the cost of sewage disposal and the village constructed the sewer system.

It is proposed by the plans presented to reduce the size of one of the main trunk lines along Branch brook from North Bedford avenue to a point about 900 feet northerly from 18 inches to 12 inches and to increase the gradient of this sewer from .2 to .25 per cent. It is proposed to construct this sewer of cast-iron pipe in order to better insure a minimum infiltration of ground water.

It is proposed also to increase the size of the sewer leading from the main trunk sewer to Kisco avenue from 8 inches to 10 inches and to reduce the grading of this sewer from .328 to .30 per cent.

From a careful examination of the plans proposed and from a consideration of the capacity of these sewers as proposed and their structural and hydraulic features, it is believed that these proposed amendments will provide sewers which will satisfactorily serve the purpose for which they are intended, and I would therefore recommend that the plans be approved.

Respectfully submitted,

THEODORE HORTON,
Chief Engineer

ALBANY, N. Y., *May* 17, 1915

PERMIT

Application having been duly made to the State Commissioner of Health, as provided by section 77 of chapter 49 of the Laws of 1909, the "Public Health Law," as amended by chapter 553 of the Laws of 1911, constituting chapter 45 of the Consolidated Laws, permission is hereby given to the board of trustees of the village of Mt. Kisco to discharge sewage from the sewers

along Branch brook and over private right of way, as shown by plans approved this day, into the waters of Kisco river through the outfall pipe of the sewage disposal works of the village within the municipality of Mt. Kisco in accordance with the plans accompanying the petition, under the following conditions:

1. That this permit shall be revocable at any time or subject to modification or change when in the judgment of the State Commissioner of Health such revocation, modification or change shall become necessary.
2. That the issuance of this permit shall not be deemed to affect in any way action by this Department on any future application that may be made for permission to discharge additional sewage or effluent into the waters of this State.
3. That only sanitary or domestic sewage and no storm water or surface water from streets, roofs or other areas shall be admitted to the proposed sewers.
4. That all the sewage to be collected by the proposed sewers shall, before it is discharged into the Kisco river, be passed through the sewage disposal plant of the village of Mt. Kisco.

LINSLY R. WILLIAMS,
Deputy State Commissioner of Health

May 17, 1915

HERMANN M. BIGGS, M.D., *State Commissioner of Health:*

Plans for the modification of a portion of the sewer system of the village of Mt. Kisco were submitted to this Department for approval by the board of trustees on June 25, 1915.

According to the plans and a communication received from the village authorities, the alignment of the lower portion of Mill street near its intersection with Main street has been changed and the plans provide for constructing some 368 feet of 6-inch sewer in that portion of Mill street tributary to the existing sewer in Main street. The new sewer will connect with the Main street sewer about 180 feet above the existing sewer in Mill street.

The proposed sewer is to be six inches in diameter and a manhole is to be constructed at its intersection with the existing sewer in Main street, to which it is tributary. Another shallow reinforced concrete manhole is also to be located at the point of change of alignment of the sewer over the arch culvert crossing Mt. Kisco river. The upper portion of the proposed sewer is to be constructed with a slope of .6 per cent and the slope of the lower portion of the sewer is to be 3.36 per cent.

In conclusion I would state that it is found from our examination of plans that the proposed sewer, if properly constructed, should satisfactorily serve the purpose for which it is intended, and I would therefore recommend that the plans be approved.

Respectfully submitted,

THEODORE HORTON,
Chief Engineer

ALBANY, N. Y., *June* 30, 1915

PERMIT

Application having been duly made to the State Commissioner of Health, as provided by section 77 of chapter 49 of the Laws of 1909, the "Public Health Law," as amended by chapter 553 of the Laws of 1911, constituting chapter 45 of the Consolidated Laws, permission is hereby given to the board of trustees of the village of Mt. Kisco to discharge sewage from the proposed sewer in Mill street into the waters of Kisco river through the outfall pipe of the sewage disposal works of the village within the municipality of Mt. Kisco in accordance with the plans accompanying the petition, under the following conditions:

1. That this permit shall be revocable at any time or subject to modification or change when in the judgment of the State Commissioner of Health such revocation, modification or change shall become necessary.

2. That the issuance of this permit shall not be deemed to affect in any way action by this Department on any future application that may be made for permission to discharge additional sewage or effluent into the waters of this State.

3. That only sanitary or domestic sewage and no storm water or surface water from streets, roofs or other areas shall be admitted to the proposed sewers.

4. That all the sewage to be collected by the proposed sewers shall, before it is discharged into the Kisco river, be passed through the sewage disposal plant of the village of Mt. Kisco.

LINSLY R. WILLIAMS,
Deputy State Commissioner of Health

July 1, 1915

NEW ROCHELLE

HERMANN M. BIGGS, M.D., *State Commissioner of Health:*

Plans for proposed sewer extensions in the Highland Park section of the city of New Rochelle, Westchester county, were submitted to this Department by the commissioner of public works of the city on December 16, 1914.

With these plans were also submitted plans for sewer extensions in the Broadview and Forest Heights districts together with general plans for the disposal of sewage of the city. The plans for sewage disposal were not in satisfactory condition for approval and were therefore returned to the city authorities without your approval together with the plans for sewer extensions in the Broadview and Forest Heights districts on December 31.

It was stated by the city officials at a conference held with them at your office in New York city on November 25, 1914, that the conditions around the reservoir of the New York Interurban Water Company were very insanitary, that cesspools were overflowing, that there were urgent needs for sewers in that section, and that it was considered by them that, irrespective of the requirements of this Department with reference to sewage disposal, permission should be granted for construction of sewers in the vicinity of the reservoir in order to protect the water supply derived from it. In view of the above it was recommended by me in my report on the examination of plans for sewage disposal under date of December 29, 1914, that action on plans for sewer extensions be deferred pending the submission of suitable plans for sewage disposal of the city unless perhaps plans for sewers in the immediate vicinity of the reservoir of the New York Interurban Company be approved. This recommendation was concurred in by you.

The plans for sewers now under consideration provide for sewer extensions in Lake drive, Webster avenue, North avenue and other streets in the so-called Highland Park district in the vicinity of the reservoir of the New York Interurban Water Company and cover an area of some 100 acres not including the area of the reservoir. This sewer district is situated in the northwestern part of the city and is bounded approximately by Webster avenue on the west, Aberfoyle road on the north, North avenue on the east and Eastchester road on the south. The reservoir of the water company is bounded by Eastchester road, North avenue and Lake drive, which streets are from 20 to 300 feet from the reservoir. Lake drive skirts the reservoir on the southwest, west and northwest and is not more than 20 or 30 feet from the water's edge at some points.

The proposed sewers as planned are to be 8 to 10 inches in diameter and are to be constructed with slopes sufficiently steep to give self-cleansing velocities in them under ordinary conditions of flow. Manholes are to be installed at all points of change of slope and alignment and flush tanks are to be placed at the upper ends of all lateral sewers. All of the proposed sewers are planned to discharge into the existing sewers in North avenue and Eastchester road tributary to the Bailey's Rock outlet sewer.

From our examination of the plans it is found that the proposed sewers, if properly constructed, should satisfactorily care for the sanitary sewage of the section to be served by them. Owing, however, to the close proximity of Lake drive to the reservoir, I am of the opinion that the sewers in this street should be constructed of cast-iron pipe with leaded joints in order to better protect the water supply from pollution from this source.

In view of the above, and after careful consideration of the essential features of the design and of the local requirements with respect to sewerage and sewage disposal, I would recommend that the plans for the proposed sewers be approved and a permit be issued allowing the discharge of the sewage to be collected by these sewers into Long Island Sound through the Bailey's Rock outfall sewer, on the following conditions:

1. That the proposed sewers in Lake drive, the lower sections of the sewers in Parcot and Otsego avenues and the lower two sections of the sewers in Flandreau avenue be constructed of cast-iron pipe with leaded joints.
2. That none of the proposed sewers except those in Lake drive, Parcot avenue, Otsego avenue and Flandreau avenue shall be constructed until satisfactory detailed plans for the proper disposal of the sewage of the entire city have been submitted to this Department for approval.

Respectfully submitted,

THEODORE HORTON,
Chief Engineer

ALBANY, N. Y., *January* 8, 1915

PERMIT

Application having been duly made to the State Commissioner of Health, as provided by section 77 of chapter 49 of the Laws of 1909, the "Public Health Law," as amended by chapter 553 of the Laws of 1911, constituting chapter 45 of the Consolidated Laws, permission is hereby given to the board of public works of the city of New Rochelle to discharge sewage from the proposed sewer extensions in Lake drive, Parcot avenue, Otsego avenue and Flandreau avenue into the waters of Long Island Sound through the Bailey's Rock outfall sewer within the municipality of New Rochelle in accordance with the plans accompanying the petition, under the following conditions:

1. That this permit shall be revocable at any time or subject to modification or change when in the judgment of the State Commissioner of Health such revocation, modification or change shall become necessary.
2. That the issuance of this permit shall not be deemed to affect in any way action by this Department on any future application that may be made for permission to discharge additional sewage or effluent into the waters of this State.
3. That only sanitary or domestic sewage and no storm water or surface water from streets, roofs or other areas shall be admitted to the proposed sewers.
4. That none of the proposed sewers except those in Lake drive, Parcot avenue, Otsego avenue and Flandreau avenue shall be constructed until satisfactory detailed plans for the proper disposal of the sewage of the entire city have been submitted to and approved by this Department.
5. That the proposed sewer in Lake drive, the lower section between manholes of the sewer in Parcot avenue and the lower section of the sewer in Otsego avenue and the two lower sections of the sewer in Flandreau avenue, as shown by the plans, shall be constructed of cast-iron pipe with watertight leaded joints.

LINSLY R. WILLIAMS,
Deputy State Commissioner of Health

January 13, 1915

NISKAYUNA (Sewer District No. 1)

HERMANN M. BIGGS, M.D., *State Commissioner of Health:*

Plans for proposed sewer extensions in Sewer District No. 1 in the town of Niskayuna, Schenectady county, were submitted to this department for approval by the Sewer Commissioners on June 19, 1915.

Original plans for a sanitary sewer system in this sewer district tributary to the Schenectady city sewer system and sewage disposal works were approved by this department on September 19, 1913. The plans now presented show that the sewer district has been extended to include a comparatively small area adjacent to the district in the vicinity of Van Antwerp road, and provide for the construction of some 1,000 feet of 8-inch sewers in Van Antwerp road and Plum street covering the annexed portion of the district. These sewers are to be tributary to the existing sewer in Plum street and are to be constructed with slopes of from .4 per cent. to 4.42 per cent. Manholes are to be placed at all points of change of alignments and the maximum spacing between adjacent manholes is 430 feet.

It is found from our examination of plans that the proposed sewers, if properly constructed, should satisfactorily meet the purpose for which they are intended and I would, therefore, recommend that the plans be approved and a permit be issued allowing the discharge into the Mohawk river of sewage from the proposed sewers after such sewage shall first have been passed through the city of Schenectady sewage disposal works.

Respectfully submitted,

THEODORE HORTON,

Chief Engineer

ALBANY, N. Y., *July 6, 1915*

PERMIT

Application having been duly made to the State Commissioner of Health, as provided by Section 77 of Chapter 49 of the Laws of 1909, the "Public Health Law," as amended by Chapter 553 of the Laws of 1911, constituting Chapter 45 of the Consolidated Laws, permission is hereby given to Sewer Commissioners, District No. 1, town of Niskayuna, to discharge sewage from the proposed sewer extensions in VanAntwerp road and Plum street into the waters of the Mohawk river through outlet of Schenectady city sewage disposal plant within the town of Niskayuna in accordance with the plans accompanying the petition, under the following conditions:

1. That this permit shall be revocable at any time or subject to modification or change when in the judgment of the State Commissioner of Health such revocation, modification or change shall become necessary.
2. That the issuance of this permit shall not be deemed to affect in any way action by this department on any future application that may be made for permission to discharge additional sewage or effluent into the waters of this State.
3. That only sanitary or domestic sewage, and no storm water or surface water from streets, roofs or other areas shall be admitted to the proposed sewers.
4. That the sewage from the proposed sewer extensions shall be passed through the sewage disposal works of the city of Schenectady.

LINSLY R. WILLIAMS,

Deputy State Commissioner of Health

July 7, 1915

NORTH HEMPSTEAD (Property of Isaac Guggenheim)

HERMANN M. BIGGS, M.D., *State Commissioner of Health:*

Plans for sewage disposal for the estate of Mr. Isaac Guggenheim in the town of North Hempstead, Nassau county, were submitted for your approval on August 2, 1915.

The plans were prepared by the New York Sewage Disposal Company of which Mr. George L. Robinson is president, and comprise duplicate blue prints of the following plans:

1. General plan of sewers, force main, outfall sewer and disposal plant.
2. Plan and details of disposal plant.
3. Plan and elevation of settling tank and chlorinating apparatus.
4. A United States Geological Survey quadrangle topographical sheet showing the location of the Guggenheim property on the north shore of Long Island near the mouth of Hempstead Harbor.

The report of the engineer states that it is proposed to care for the sewage from all the buildings on the property in the proposed sewage disposal plant with the exception of the superintendent's cottage and the golf house. It is estimated that the average daily sewage flow will be about 8,000 gallons with a possible maximum of 12,000 gallons. The average sewage flow of the buildings mentioned above is to be intercepted and conveyed to a single disposal plant.

The sewage of the main building, estimated at a maximum flow of about 5,000 gallons per day, is to be diverted to a 6-inch vitrified pipe sewer, which will extend about 1,800 feet to a group of farm buildings. The report of the designing engineer states that this sewer may be located somewhat different than as shown on the plan because of the placing of the shrubbery and other landscape features and for this reason the gradients are not shown. An examination of the contours indicated on the plans shows that the sewer will have a total fall in its length of 1,765 feet of approximately 65 feet, which gives an average gradient of about 3.6 per cent. The sewer is to be laid at a depth of approximately 4 feet below grade. The slope should be sufficiently steep to provide self-cleansing velocities of the sewage in the sewer and prevent clogging. The maximum spacing between manholes is 440 feet.

A 6-inch sewer already constructed will convey the sewage from the manhole above described to a point in front of the barn, where it will be intercepted and conveyed to the proposed disposal works. The disposal works are to consist of a settling tank, sludge bed, chlorinating plant, and pump. Upon reaching the disposal plant the sewage enters the settling compartment of the settling tank, which is to be a horizontal flow tank of the Imhoff type. The settling tank is to be constructed of concrete and brick and is to be provided with a concrete roof. The settling compartment will have a total capacity of about 5,000 gallons, which for the maximum flow of 12,000 gallons will provide an average period of detention of the sewage in the tank of about 10 hours. It appears from the plans and from the report of the designing engineer that the settling tank will have a slot into the sludge compartment for only about two-thirds of its length and that the sludge which settles into the bottom of the remainder of the settling compartment is to be removed through the sludge pipe by means of a pipe connection provided for that purpose. The sludge compartment has a volume, taken below a point about 1 foot below the slot, of about 212 cubic feet, which should provide a period of detention of the sludge in the sludge compartment of from 1 to 1.5 years. The sludge is to be pumped out through a 3-inch sludge pipe connected to a single stage, hand controlled, centrifugal pump, actuated by a 3 horse power Western Electric Form K, squirrel cage motor. The sludge pipe is cross connected with the force main for the clarified and chlorinated sewage in such a manner that the clarified sewage may be pumped through the sludge pipe in order to clear it out. A ½-inch water-pipe

extending to the bottom of the sludge pipe is also provided to break up the sludge. As the gas vent is 7 feet in diameter and probably about 11 feet deep above the slot, constant care should be used to keep the scum cleaned out since this large area offers opportunity for its accumulation.

Two sludge beds are to be provided to drain and dry the sludge from the settling tank. These sludge beds are to be constructed with concrete walls, bottom and roof, having an opening closed by iron doors over each bed. The beds will each be 10 feet by 10 feet in plan and will consist of 1 foot 6 inches of gravel and 2 feet 6 inches of sand. The sludge will be distributed over them through half tile pipes and the beds will be underdrained by 6-inch vitrified tile pipes laid on the concrete floor. The underdrains are to drain into the settling tank. The sludge beds will have a total area of 200 square feet sufficient for about 550 people.

The sewage is to leave the settling tank through a submerged vitrified pipe outlet, which connects with the absorption tower of the chlorinating apparatus. The chlorinating apparatus it is stated in the report of the designing engineer is to be of the type manufactured by the Electric Bleaching Gas Company. The amount of chlorine, which will be used is not given. The sewage after receiving the disinfectant passes through a 6-inch vitrified pipe to the end of a mixing channel 16 feet 8 inches long by 3 feet wide and with its bottom on the level of the flow line. From the mixing channel the chlorinated sewage is to flow into a sump well 16 feet 8 inches by 8 feet in plan and 6 feet deep below the indicated flow line. The period of detention of the sewage in the sump well for a maximum flow of 12,000 gallons per day will be about 12 hours. The sewage should be pumped below the indicated point, otherwise it will probably be necessary to use a high rate of application of the chlorine in order to preserve the sewage during the 12 hours.

The sewage is to be pumped by means of two stage centrifugal pumps actuated by two 7½ H. P., 1,200 R. P. M. 220 volt 2 phase, 60 cycle, Western Electric vertical motors. The report of the designing engineer states that there will be automatic self-starters, with float switches, float, pulleys, etc. Suitable wooden buildings are to be provided to cover the motors and chlorinating apparatus. The sewage will be pumped through a 3-inch force main about 1,800 feet to a point near the main residence, after which it will flow by gravity about 1,300 feet into Hempstead Harbor.

In view of the results of our examination of these plans and after careful consideration of the essential features of the design and of local and general requirements with respect to proper methods for the disposal of the sewage from the property, it appears that the disposal plant when examined on the basis of the data regarding sewage flow furnished by the designing engineer, is of excessive capacity and the several structures could be reduced in size with economy and with considerable benefit to the operation of the plant. The period of detention of the sewage in the settling tank is equivalent to that of a tank designed to produce a septicized effluent and therefore the arrangement of the tank as an Imhoff tank is unnecessary. It would be advantageous if the tank is to be used as an Imhoff tank to provide a slot for the settling of the solids into the sludge chamber throughout the length of the settling compartment. This would eliminate the connection with the sludge pipe. If the mixing obtained in the sump well, pumps, 1,800 feet of force main and outfall sewer is not considered sufficient and the mixing channel is not eliminated, its bottom should be lowered to give some depth of flow in it.

I, therefore, beg to recommend that the plans be approved on condition:

1. That at least 5 parts per million by weight of chlorine be added to the effluent and that this amount be increased whenever required by the State Commissioner of Health.
2. That the outfall sewer be so maintained as to discharge below low water stage.

Respectfully submitted,

THEODORE HORTON,
Chief Engineer

ALBANY, N. Y., *August* 11, 1915

PERMIT

Application having been duly made to the State Commissioner of Health, as provided by Section 76 of Chapter 49 of the Laws of 1909, the "Public Health Law," as amended by Chapter 553 of the Laws of 1911, constituting Chapter 45 of the Consolidated Laws, permission is hereby given to Mr. Isaac Guggenheim to discharge effluent from the proposed sewage disposal works to treat the sewage from his estate in the town of North Hempstead, Nassau county, into the waters of Hempstead Harbor at point of discharge shown by the plans within the town of North Hempstead in accordance with the plans accompanying the petition, under the following conditions:

1. That this permit shall be revocable at any time or subject to modification or change when in the judgment of the State Commissioner of Health such revocation, modification or change shall become necessary.
2. That the issuance of this permit shall not be deemed to affect in any way action by this department on any future application that may be made for permission to discharge additional sewage or effluent into the waters of this State.
3. That both the sewers and sewage disposal works shown by plans approved this day shall be fully constructed in complete conformity with such plans or approved amendments thereof.
4. That only sanitary or domestic sewage, and no storm water or surface water from grounds, roofs or other areas shall be admitted to the proposed sewers.
5. That no sewage sludge from any part of the disposal works shall be discharged into Hempstead Harbor or any other watercourse or body of water.
6. That at least 5 parts of chlorine per million parts of sewage shall be at all times properly applied to the effluent and that this amount shall be increased whenever required by the State Commissioner of Health.
7. That the outfall sewer shall be so maintained as to discharge below low water stage.

LINSLY R. WILLIAMS,
Deputy State Commissioner of Health

August 20, 1915

NORTH HEMPSTEAD (Great Neck Sewer District)

HERMANN M. BIGGS, M.D., *State Commissioner of Health:*

Plans for a separate sewer system and a sewage disposal plant for the Great Neck Sewer District in the town of North Hempstead, Nassau county, were submitted to this department for approval by the Sewer Commissioners thereof on April 2, 1915.

These plans were previously submitted on March 5, 1915, at which time they were given a preliminary examination by the engineering division which showed that it would be necessary to make certain modifications, additions or changes as indicated below, before the plans could be finally approved and they were, therefore, returned to the designing engineer on March 26, 1915, with recommendations that they be revised in the following respects:

1. Owing to the location of the wells on the Manhasset Lakeville water district near the East Shore road the proposed sewer in this street between the Long Island Railroad and Beverly road should be constructed of cast iron pipe with watertight joints.
2. The pumps and motors of the sewage pumping stations should be shown by the plans.
3. The placing of screens in front of the suction pipes of the pumping stations where the screens would not be readily accessible for cleaning is an unsatisfactory arrangement. The sewage should be passed through coarse bar screens placed in screen chambers located either on the line of sewers outside of the pump wells or directly inside of the pump wells.

Another alternative would be to provide for basket screens which might be hung under the inlet ends of the sewers entering the pump wells.

4. A duplicate or auxiliary source of power to operate the pumps in case of emergency should be provided in both of the sewage pumping stations. This requirement may be met in a number of ways, such as by having two independent sources of electricity; by installing an engine arranged to drive an electric generator to produce electricity to operate the motors in case of a breakdown of the proposed source of electricity, or by installing an engine so arranged as to operate one of the proposed pumps or to operate an additional pump installed in connection with it.

5. Details of the sludge pit and pumping equipment to pump the sludge to the sludge drying beds should be shown.

6. The capacity of the different pumps under normal operating conditions should be indicated.

The plans now submitted had been revised in accordance with all of the above recommendations. They were prepared by Carl H. Watson, civil engineer, Great Neck, L. I., and comprise tracings and blue prints of the following:

1. General topographical map of the sewer district showing proposed sewer system and sewage disposal works.
2. General plans of sewage disposal works.
3. Three sheets showing details of sewage disposal plant.
4. Three sheets showing details of pumping stations.
5. Eighteen sheets showing profiles and details of sewers.

The report of the engineer states that the sewer district which includes the Kensington District, plans for which were approved on July 1, 1913, has at present some 420 houses and a population of about 2,100 persons, and that all but 40 of these houses representing a population of about 160 are served by cesspools which owing to the nature of the soil frequently overflow giving rise to general insanitary conditions. The remainder of the houses in the sewer district are served by sewers which discharge without treatment into Manhasset bay. It is for the purpose of providing adequate sewerage facilities in the district and removing the objectionable conditions caused by the use of cesspools that the proposed sewerage and sewage disposal systems are to be installed.

The sewer district is situated in the northern part of the town of North Hempstead on the drainage areas of both Manhasset and Little Neck bays. It is provided with two sources of water supply taken from driven wells. One of these supplies is furnished by the Manhasset-Lakeville Water District from five driven wells located on a flat low area near the East Shore road, a short distance north of the Long Island Railroad. These wells are said to be driven to a depth of 150 feet. The other supply is furnished by the Citizens Water Company at Elmhurst from driven wells located near Little Neck bay. About 10 per cent of the population of the sewer district is provided with sewers which discharge into Manhasset bay near the side of the proposed sewer plant about 200 feet south of Vista road extended.

The present population of the sewer district according to the report of the engineer is approximately 2,100 and its area 610 acres, giving a density of about 3 persons per acre. The increase in the population of the district has been fairly rapid especially in the vicinity of the railroad station of the North Side Division of the Long Island Railroad and based on an assumed density of population of 15 persons per acre it is estimated that the population ultimately to contribute sewage from the sewer district will be approximately 10,000.

The sewer district is divided by a ridge running in a general northerly and southerly direction into two major drainage areas, one of which drains toward the east into Manhasset bay and the other towards the west into Little Neck bay. These two major areas are in turn divided into two minor watersheds making four drainage areas designated on the plans as areas A, B, C, and D.

It appears from the report of the designing engineer that various methods of caring for the sewage from the sewer district together with the cost of collecting and conveying the sewage to different sites available for disposal, have been given careful study and consideration by the engineer. It is found that owing to the topography of the district all but one of the methods studied require one or more pumping stations and that in order to avoid pumping and provide for a gravity system throughout it would be necessary to construct four sewage disposal plants and two long outfall sewers. Considering the difficulty of obtaining rights of way for long outfall sewers through private property and incorporated villages, the gravity plan was abandoned and the proposed method of collecting and conveying the sewage to a disposal plant in District C. was adopted. This plan requires pumping the sewage from areas A. B. and D. into the sewer system of District C. One of the proposed pumping stations to be located in the western section of the district is to serve areas A. and B. and the other in the eastern part of the district is to serve area D. It is also proposed to incorporate the existing sanitary sewers in Kensington into the proposed system.

Sewer system

The proposed sewers are to vary in size from 8 to 24 inches in diameter and are for the most part to be laid on fairly steep slopes. Manholes are to be installed at all points of change of slope or alignment and at intermediate points not more than 450 feet apart. All sewers are to be constructed with straight alignments between adjoining manholes. The portion of the sewer in the East Shore road between the Long Island Railroad and Beverly road is to be constructed of cast iron pipe with watertight lead joints. Cast iron pipe is also to be used in the case of railroad crossings and where a cover of more than 3 feet over the crown of the sewer can not be obtained.

Pumping station

As noted above the sewage from the areas A. and B. is to be collected and conveyed by gravity flow to the pumping station located along Little Neck road near the northwestern corner of the sewer district. From this point the sewage is to be discharged against a static head of about 60 feet through some 3,500 feet of 8-inch iron pipe into one of the proposed sewers in District C. tributary to the disposal plant. The second pumping station serving area D. is to be located near Bayview avenue east of the East Shore road. From this point the sewage is to be pumped into a manhole in the East Shore road immediately north of the right of way of the Long Island Railroad from which it will flow by gravity to the proposed sewage disposal plant.

Each pumping station is to comprise a suction well having a capacity of about 21,000 gallons, a pump well and a motor or operating room. It is planned to hang a basket screen having clear openings of 2 inches under the inlet end of the inlet pipe at each pumping station.

These basket screens are to be hung near the bottom of the suction wells where they will be submerged for the greater portion of the time. It would appear, therefore, that these screens would be more readily accessible for removal and for cleaning and be more effective in operation if they were hung nearer the flow line of the suction well where they would not be entirely submerged.

The pumping stations which are to be of similar design are to be equipped with duplicate units or electrically driven centrifugal pumps. Each pumping unit is to consist of a vertical pump which is to discharge into the suction of a horizontal pump so that these pumps will operate in series and act as a single two stage pump. Each of the pumps of the different units is to be driven by an independent electric motor. According to the report of the designing engineer each unit will have a capacity of 250 gallons per minute so that the maximum capacity of the two pumping stations with all units in operation will be about 1,440,000 gallons a day.

The electric current to drive the pumping equipment is to be furnished by the Nassau Light & Power Company. It is stated in the report that this company has a substation located within the sewer district which receives power from the Glenwood Power Station and from the Roslyn Power Station, both of which are equipped with reserved auxiliary generators. It is further stated that the lighting company has agreed to install and maintain in their substation a special private transformer to be connected with their main power delivery circuit to be used in transforming such currents as will be needed to run the pumps at the pumping station. Provisions are also to be made for the construction of underground cable conduits to the pumping stations. The report of the engineer further states that if, in the future, it is found necessary to add an auxiliary source of power, it is proposed to install a gas engine generator set in a building adjacent to the substation, and there produce current to be fed over the private lines installed by the lighting company. It would appear, therefore, that ample provisions have been made to give reasonable assurance that there will be a continuous operation of the pumping stations.

Sewage disposal

It is proposed to treat the sewage collected by the sewer system in the sewage disposal plant consisting of settling tanks, sludge beds and a sterilization plant located in the northeasterly section of the sewer district between the East Shore road and Manhasset bay. The bay has a drainage area at this point of about $3\frac{1}{4}$ square miles. According to the report of the designing engineer a boat channel 6 feet deep at low tide and from 250 to 300 feet wide, which extends about 1,000 feet above the outfall of the disposal plant was dredged a few years ago. The difference of elevation of mean high and mean low tides is shown on the plans as about 8 feet, giving a daily tidal displacement of the section of the bay above the plant of about 25,000,000 gallons. It is also stated in the engineer's report that the overflow from the Payne-Whitney pond into the head of the bay is about 10,000 gallons per minute, equal to about 1,400,000 gallons per day. The total dilution offered by the tidal flow and by the fresh water from the pond is therefore nearly 1 to 30, assuming an ultimate daily flow of sewage of 1,000,000 gallons.

Disposal plant

The site for the disposal plant, which is irregular in shape, comprises an area of about $3\frac{1}{2}$ acres and has a frontage on the East Shore road of 360 feet and a depth between this road and Manhasset bay of about 600 feet. Although the highway is only from 40 to 80 feet from the upper ends of the settling tanks of the disposal plant, all of the structures except the sludge drying beds are to be covered, and it is planned to plant hedges and shrubbery around the disposal works. It is also stated in the engineer's report that if it is found that any objectionable odors are given off from the contact beds when in operation, steel frame buildings, with glass roofs will be erected over the sludge beds. It is probable therefore that, in view of these precautions and provided the plant is properly operated, that no objectionable conditions will be created by the operation of the plant. The site moreover apears to be large enough to provide for future extensions. Although only one of the settling tanks and two sludge beds are to be constructed at first, the plans show in general the location of two additional tanks and four sludge beds to be constructed in the future and designed to serve an ultimate population of 10,000 persons. The works as designed are located sufficiently high to be above the influence of high water in the bay.

Settling tanks

The proposed settling tank to be constructed first is to be divided into four units of equal size. Each unit is 100 feet long, 12 feet wide and from 7 to 10 feet deep below the flow line, giving a capacity of about 72,000 gallons

for each unit. It is proposed to operate two units of each tank in parallel until the efficiency of the units is reduced by the accumulation of sludge, when these two units are to be cut out of use and the two remaining units of the tank put in operation. The units thus thrown out of service are to rest full to allow the sludge to digest, after which it is to be discharged by gravity to the sludge pit through sludge pipes connected with the deepest portion of each unit. From the sludge pit the sludge is to be pumped to the sludge drying beds.

No statement is made as to the length of time that each set of units of the settling tanks is to be operated before being cut out of service. This of course is a matter that cannot be determined definitely without a series of tests under operating conditions; but it may be stated in general that unless the tanks are to be operated under continuous and intelligent operation and by a man competent to make elementary tests of the operation of the plant, no set of units should be operated continuously for more than one year inasmuch as it is probable that sufficient scum and sludge will accumulate in that time to reduce the efficiency of the plant below a desirable limit.

Two units of the tank to be constructed at first will have sufficient capacity to give about 16 hours' detention of sewage when serving the present population of 2,100 persons, assuming a per capita rate of sewage contribution of 100 gallons per day. When serving the estimated ultimate population of the district three tanks operated as described above will give about 10 hours' detention of the sewage.

Sterilization plant

From the settling tanks the settled sewage is to be passed through a sterilization plant, where it is to be treated with chlorine gas before it is discharged into the bay. This gas, after being mixed with water, is to be applied near the inlet of the detention basin of the sterilization plant at a point 3½ feet below the flow line of the chamber. This detention chamber is 25 feet long, 18 feet wide and about 4½ feet deep below the flow line, giving a capacity of about 15,000 gallons, which is equal to an average flow of about 20 minutes when serving the population of 10,000 persons. The treated effluent is to be discharged through a 24-inch pipe at a point about 60 feet from the shore and at a depth of about 5 feet below low tide. The portion of the effluent pipe from the shore to the outlet is to be of cast-iron and the portion between the shore and sterilization plant is to be of vitrified tile.

The report of the engineer states that it is proposed to use 40 pounds of chlorine gas per million gallons of sewage treated. This is equal to nearly 5 parts of chlorine per million parts of sewage. I am of the opinion that not less than 5 parts of chlorine per million parts of sewage should be used in treating the effluent from the settling tanks and that this amount should be increased if it is found that satisfactory results are not obtained by using 5 parts per million.

Sludge disposal

As noted above, the sludge from the settling tanks is to be discharged by gravity flow under a head of 14 feet into a sludge pit located between the settling tanks and the sludge drying beds. From this pit it is proposed to pump the sludge by means of an electrically driven sludge pump having a 6-inch suction and 4-inch discharge. The floor of the motor room of the sludge pit is about eight feet below the flow line of the settling tanks and, although the inlet from the settling tanks to the sludge pits is to be controlled by a valve by means of which the flow may be regulated, I am of the opinion that it would be advisable to raise the floor of the operating room to the level of the flow line of the settling tanks in order that the motors operating the pumps may not be flooded by a too rapid discharge of sludge from the settling tanks.

It is proposed to construct two sludge beds at present. Each bed is to be 30 feet square and is to be filled to a depth of 24 inches with filtering material consisting of a top layer of sand 12 inches deep and a lower layer of gravel also 12 inches in depth. The beds are to be underdrained by parallel

lines of bell and spigot pipe laid with open joints and spaced four feet center to center. These drains are to connect with an 8-inch collecting drain which is to discharge into the sterilization chamber, where the effluent is to be treated with chlorine gas before being discharged into the bay.

Conclusions and recommendations

In conclusion I would state that it is found from our examination of plans that the proposed sewerage and sewage disposal systems should care for the sanitary or domestic sewage of the Great Neck Sewer District in a satisfactory manner and that the proposed sewage disposal plant if operated with care and efficiency should produce effluent which may safely be discharged into Manhasset bay without objection at this time. It may be found, however, in the future after the district becomes more fully developed that it will be necessary to provide for organic or more complete treatment of the sewage than that provided for by the present plans.

In view of the above and after a careful consideration of the essential features of the design and of the local and general requirements with respect to sewage disposal for the sewer district, I would recommend that the plans be approved and a permit be issued allowing the discharge into Manhasset bay in the town of North Hempstead of effluent from the proposed sewage disposal plant. I would further recommend that the permit contain in addition to the usual revocation and modification clauses the following conditions:

1. That the different units of the settling tanks be not operated continuously for more than one year without cleaning.
2. That chlorine shall be applied to the effluent from the settling tanks in the proportion of not less than five parts of chlorine to one million parts of effluent before it is discharged into Manhasset bay and that this proportion shall be increased when required by the State Commissioner of Health.
3. That whenever required by the State Commissioner of Health satisfactory detailed plans for additional works for more complete treatment of the sewage of the Great Neck Sewer District shall be submitted for approval; and upon approval of such plans any or all portions of such additional or supplementary works for more complete treatment of the sewage shall be constructed and put in operation at such time or times thereafter as said Commissioner may require.

Respectfully submitted,

THEODORE HORTON,
Chief Engineer

ALBANY, N. Y., *April 7, 1915*

PERMIT

Application having been duly made to the State Commissioner of Health, as provided by section 77 of chapter 49 of the Laws of 1909, the "Public Health Law," as amended by chapter 553 of the Laws of 1911, constituting chapter 45 of the Consolidated Laws, permission is hereby given to the Sewer Commissioners of the Great Neck Sewer District to discharge effluent from the sewage disposal works to be constructed in connection with the proposed sewer system of the Great Neck Sewer District into the waters of Manhasset bay at the point of discharge shown by the town of North Hempstead in accordance with the plans accompanying the petition, under the following conditions:

1. That this permit shall be revocable at any time or subject to modification or change when in the judgment of the State Commissioner of Health such revocation, modification or change shall become necessary.
2. That the issuance of this permit shall not be deemed to affect in any way action by this Department on any future application that may be made for permission to discharge additional sewage or effluent into the waters of this State.

3. That both the sewer system and the sewage disposal works shown by plans approved this day shall be fully constructed in complete conformity with such plans or approved amendments thereof.

4. That only sanitary or domestic sewage and no storm water or surface water from streets, roofs or other areas shall be admitted to the proposed sewers.

5. That no sewage sludge from any part of the disposal works shall be discharged into Manhasset bay or any other watercourse or body of water.

6. That the different units of the settling tanks shall not be operated continuously for more than one year without cleaning.

7. That chlorine shall be properly applied to the effluent from the settling tanks at all times in the proportion of not less than five parts of chlorine to one million parts of effluent before it is discharged into Manhasset bay and that this proportion shall be increased when required by the State Commissioner of Health.

8. That whenever required by the State Commissioner of Health satisfactory detailed plans for additional works for more complete treatment of the sewage of the Great Neck Sewer District shall be submitted for approval and upon approval of such plans any or all portions of such additional works for more complete treatment of the sewage shall be constructed and put in operation at such time or times thereafter as said Commissioner may designate.

LINSLY R. WILLIAMS,
Deputy State Commissioner of Health

April 8, 1915

NORTH HEMPSTEAD (Property of R. N. L. Church)

HERMANN M. BIGGS, M.D., *State Commissioner of Health:*

Plans for sewage disposal from the property of Mr. Richard N. L. Church at Hewlett Point, Great Neck, in the town of North Hempstead, Nassau county, were submitted to this department for approval on March 25, 1915.

This property is located near the northerly point of Great Neck on Long Island Sound. According to the report of the designing engineer, the sewage from the residence of Mr. Church is at present discharged into a cesspool provided with an overflow pipe which discharges into Long Island Sound. It is now proposed to intercept the sewer leading from the residence to the cesspool and to treat the sewage from the residence, garage and stable in a sewage disposal plant consisting of a settling tank, dosing chamber and covered intermittent sand filter to be located between the stable and the Sound at a distance of some 500 feet from the residence. It is stated that the average summer population varies from twelve to fifteen persons with an occasional week-end population of twenty-five. The winter population is from five to six persons. The design of the disposal plant is based on a daily flow of sewage of from 1,200 to 2,000 gallons per day.

The proposed settling tank, which is circular in plan, is of the so-called duplex type and contains a central circular compartment or well for the storage and digestion of sludge. The settling compartment surrounds the central well and is about 1½ feet deep and 1½ feet wide near the outlet. Near the inlet the settling compartment is wedge shaped and this section extends around two-thirds of the circumference of the digestion chamber of the tank. This portion of the tank is connected with the sludge compartment by means of a slot. The detention of sewage in the tank will vary from about 10 hours in the winter to from 4.5 to 2.5 hours during the summer.

From the settling tank the effluent is to flow through a submerged outlet consisting of the "T" connection into an adjacent dosing chamber 6 feet in diameter and 1 foot deep below the flow line. From this chamber the effluent is to be discharged intermittently by means of an automatic discharge siphon onto the sand filter.

This filter as planned is to be 10 feet wide and 20 feet long and is to be surrounded by a concrete wall. It is to be filled to a depth of 2 feet with coarse sand and supported by a layer of gravel 6 inches deep. The filter is to be covered with a plank roof over which is to be placed a surface covering of loam about 1 foot deep. It is planned to have a space of 1½ feet between the sand surface and the roof of the filter. It is stated in the report of the engineer that a hatch or opening is to be left in the roof. The effluent from the filter is to be discharged into Long Island Sound below the low water mark through a 4-inch cast iron pipe.

The area of the proposed filter is about .005 of an acre and will therefore be required to operate at from 240,000 to 400,000 gallons per acre per day. The average rate of operation during the summer when serving a population of fifteen persons and assuming a rate of sewage contribution of 100 gallons per capita per day would be about 300,000 gallons. I am of the opinion that this rate of operation is excessive and would result in a rapid clogging of the surface of the filter which would necessitate a frequent removal of the covering of the filter in order to scrape the bed. Although the rate of operation on intermittent sand filters even when open and when such filters are operated at a uniform rate during the entire year should not exceed 100,000 gallons per acre per day when treating settling tank effluent, this rate could probably be exceeded somewhat in this case owing to the comparatively small population to be served by it during the winter. The rate of operation, however, should not exceed 200,000 gallons per acre per day for average summer conditions. This would require a filter having an area of about 50 per cent. greater than the proposed filter.

From the careful examination of plans it would appear that the proposed sewage disposal plant if modified somewhat and if properly constructed and maintained should produce an effluent that may safely be discharged into Long Island Sound at this time. I would therefore recommend that the plans be approved and a permit be issued allowing the discharge into Long Island Sound of effluent from the proposed sewage disposal plant on condition that the area of the sand filter be increased by not less than 50 per cent. and that it be provided with a vent pipe.

Respectfully submitted,

THEODORE HORTON,

Chief Engineer

ALBANY, N. Y., *April* 10, 1915

PERMIT

Application having been duly made to the State Commissioner of Health, as provided by section 76 of chapter 49 of the Laws of 1909, the "Public Health Law," as amended by chapter 553 of the Laws of 1911, constituting chapter 45 of the Consolidated Laws, permission is hereby given to Richard N. L. Church, Esq., to discharge effluent from the proposed sewage disposal plant to treat the sewage from his property at Hewlett Point into the waters of Long Island Sound at point of discharge shown by the plans within the municipality of town of North Hempstead in accordance with the plans accompanying the petition, under the following conditions:

1. That this permit shall be revocable at any time or subject to modification or change when in the judgment of the State Commissioner of Health such revocation, modification or change shall become necessary.
2. That the issuance of this permit shall not be deemed to affect in any way action by this Department on any future application that may be made for permission to discharge additional sewage or effluent into the waters of the State.
3. That only sanitary or domestic sewage, and no storm water or surface water from grounds, roofs or other areas shall be admitted to the proposed sewers.

4. That no sewage sludge from any part of the disposal works shall be discharged into Long Island Sound or into any other watercourse or body of water.

5. That the sand filter shall be constructed with an area 50 per cent. greater than that shown by the plans and the filter shall be properly provided with an adequate vent pipe.

LINSLY R. WILLIAMS,
Deputy State Commissioner of Health

April 14, 1915

NORWICH

HERMANN M. BIGGS, M.D., *State Commissioner of Health:*

Plans for proposed sewer extensions in the city of Norwich, Chenango county, were submitted to this Department for approval by the city engineer on behalf of the common council on May 17, 1915.

The records of the Department show that original plans for a sanitary sewer system for the then village of Norwich were approved on November 18, 1892. The plans covered all developed portions of the village and provided for a direct discharge of the sanitary sewage into the Chenango river at the foot of Birdsall street extended. The sewage from a portion of the village east of the N. Y., O. & W. R. R. and south of East Main street was to be pumped into the main sewer system tributary to the Birdsall street outlet. On April 11, 1906, plans showing the temporary outlet sewer in Grove avenue and providing for the discharge by gravity of sewage from this latter portion of the village directly into the Chenango river at the foot of Grove avenue extended were approved at the urgent request of the village authorities, thereby deferring for a time the necessity for pumping the sewage from this district.

On April 27, 1914, plans providing for still another outlet into the river at the foot of Gold street were approved. It was pointed out to the city authorities at that time, after reviewing the action previously taken by this Department with reference to the sewage of the city, that the time had come when proper provisions should in general be made by all municipalities for the concentration of sewage at one point where possible and for the disposal of such sewage by at least partial treatment and that the existing conditions did not warrant the approval of plans for additional outlets into the Chenango river.

The plans now submitted provided for comparatively short sewer extensions in Prospect and Pellett streets tributary to the main outfall sewer in Birdsall street. These sewers were to be 8 inches in diameter and are to be constructed with slopes of from .6 to 6.67 per cent. Manholes are to be constructed at all points of change of slopes and alignment and a flush tank is to be placed at the upper end of each sewer. The proposed sewers, however, are planned to be laid comparatively shallow with respect to the present surface of the streets, the covering being less than 3 feet in certain sections. The sewer should be lowered unless the streets in adjacent areas are to be so graded as to provide a fill of not less than 4 feet over the crown of the sewers not only for the purpose of protecting them from heavy traffic but also in order to provide adequate sewage facilities for residences. The proposed sewers if modified in this particular should satisfactorily care for the sanitary sewage of the sections to be served by them.

With respect to the discharge of untreated sewage from the city into the Chenango river it may be stated that as already pointed out to the city authorities the existing conditions of portions of this stream are such that steps should be taken by the city at an early date to provide for the concentration and treatment of its sewage at a suitable point. Such action would be consistent with requirements of permits granted in connection with the approval of plans for sewers in Binghamton, Oneonta, Sidney, Corning and other municipalities on the Susquehanna river and its tributaries

imposed after the completion of the sanitary survey of the Susquehanna river watershed in 1907. This survey showed that this river and tributaries were "polluted by domestic sewage and manufacturing wastes to such an extent as to impair the natural value of the streams and to destroy to a considerable extent the riparian rights of cities, villages and individual riparian owners along their courses," and that these "streams in the Susquehanna drainage basin were so grossly polluted by domestic sewage as to render the use of the main streams absolutely dangerous as sources of public water supply without filtration and that some degree of danger to public health exists if the main streams are used as public water supplies even with filtration."

The city of Norwich should take steps to provide for at least a partial treatment of the entire sanitary sewage of the city by sedimentation in a properly designed sewage disposal plant. The said plant should be so located with reference to the stream as to permit of constructing and operating by gravity flow if possible works for more complete treatment of the sewage should such additional treatment be found necessary in the future.

In view of the above I would recommend that the plans be approved and a permit be issued allowing the discharge of sewage from the proposed sewers into the Chenango river through the existing outfall sewer in Birdsall street in the city of Norwich. I would further recommend that the permit contain in addition to the usual revocation and modification clauses the following conditions:

1. That the fill over the proposed sewers shall be not less than 4 feet or that they shall be located not less than 4 feet below the proposed grade of the street.
2. That on or before October 1, 1916, plans for the interception and treatment by sedimentation of the entire sanitary sewage of the city be submitted for approval.

Respectfully submitted,

THEODORE HORTON,
Chief Engineer

ALBANY, N. Y., *June* 3, 1915

PERMIT

Application having been duly made to the State Commissioner of Health, as provided by section 77 of chapter 49 of the Laws of 1909, the "Public Health Law," as amended by chapter 553 of the Laws of 1911, constituting chapter 45 of the Consolidated Laws, permission is hereby given to the common council of the city of Norwich to discharge sewage from the proposed sewer extensions in Prospect and Pellett streets into the waters of Chenango river at the foot of Birdsall street extended within the municipality of Norwich in accordance with the plans accompanying the petition, under the following conditions:

1. That this permit shall be revocable at any time or subject to modification or change when in the judgment of the State Commissioner of Health such revocation, modification or change shall become necessary.
2. That the issuance of this permit shall not be deemed to affect in any way action by this Department on any future application that may be made for permission to discharge additional sewage or effluent into the waters of this State.
3. That only sanitary or domestic sewage and no storm water or surface water from streets, roofs or other areas shall be admitted to the proposed sewers.
4. That the fill over the proposed sewers shall be not less than 4 feet or the sewers shall be laid not less than 4 feet below the proposed grade of the street.
5. That on or before October 1, 1916, satisfactory detailed plans for preliminary treatment of the entire sanitary sewage of the city of Norwich by sedimentation accompanied by general plans for additional or

supplementary works for more complete treatment of the sewage of the city shall be submitted to this Department for approval and that after approval of said plans such works for preliminary treatment of the sewage shall be constructed and put in operation whenever required by the State Commissioner of Health.

LINSLY R. WILLIAMS,
Deputy State Commissioner of Health

June 16, 1915

HERMANN M. BIGGS, M.D., *State Commissioner of Health:*

On July 30, 1915, plans for proposed sewer extensions in the city of Norwich, Chenango county, were submitted to this Department for approval by the city engineer on behalf of the common council.

Original plans for a sanitary sewer system for Norwich were approved on November 18, 1892. Plans for modifications and extensions to the sewer system have been approved from time to time since that date. On June 16, 1915, plans for proposed sewer extensions in Prospect and Pellett streets were approved. One of the conditions of approval of these latter plans is as follows:

> "That on or before October 1, 1916, satisfactory detailed plans for preliminary treatment of the entire sanitary sewage of the city of Norwich by sedimentation accompanied by general plans for additional or supplementary works for more complete treatment of the sewage of the city shall be submitted to this Department for approval and that after approval of said plans such works for preliminary treatment of the sewage shall be constructed and put in operation whenever required by the State Commissioner of Health."

The plans now submitted provide for comparatively short sewer extensions in Tillman avenue, Terrace place and through private property between Tillman avenue and Rexford street and between Terrace place and Rexford street. These sewers are tributary to the existing sewer in Rexford street, which discharges into the Chenango river through the Birdsall street outlet sewer. The proposed sewers are to be 8 inches in diameter and are to be constructed with slopes of from .5 per cent. to 6.0 per cent. Manholes are shown at all points of change of slope and alignment, at the upper ends of the sewers and at the intersection of the proposed sewers with the existing sewers. The maximum spacing between adjacent manholes is about 300 feet.

From our examination of plans it would appear that the proposed sewers if properly constructed and made sufficiently tight to prevent excessive infiltration of ground water should satisfactorily care for the sanitary sewage of the sections to be served by them.

I would, therefore, recommend that the plans be approved and a permit be issued allowing the discharge of sewage collected by the proposed sewers into the Chenango river at the foot of Birdsall street in the city of Norwich and that the permit contain in addition to the usual revocation and modification clauses the same condition with respect to the future disposal of the sewage as is contained in the permit issued to the city on June 16, 1915.

Respectfully submitted,
THEODORE HORTON,
Chief Engineer

ALBANY, N. Y., *August* 9, 1915

PERMIT

Application having been duly made to the State Commissioner of Health, as provided by section 77 of chapter 49 of the Laws of 1909, the "Public Health Law," as amended by chapter 553 of the Laws of 1911, constituting chapter 45 of the Consolidated Laws, permission is hereby given to the

common council of the city of Norwich to discharge sewage from the proposed sewer extensions in Tillman avenue, Terrace place and through private rights of way into the waters of Chenango river at the foot of Birdsall street extended within the municipality of Norwich in accordance with the plans accompanying the petition, under the following conditions:

1. That this permit shall be revocable at any time or subject to modification or change when in the judgment of the State Commissioner of Health such revocation, modification or change shall become necessary.

2. That the issuance of this permit shall not be deemed to affect in any way action by this Department on any future application that may be made for permission to discharge additional sewage or effluent into the waters of this State.

3. That only sanitary or domestic sewage and no storm water or surface water from streets, roofs or other areas shall be admitted to the proposed sewers.

4. That on or before October 1, 1916, satisfactory detailed plans for preliminary treatment of the entire sanitary sewage of the city of Norwich by sedimentation accompanied by general plans for additional or supplementary works for more complete treatment of the sewage of the city shall be submitted to this Department for approval and that after approval of said plans such works for preliminary treatment of the sewage shall be constructed and put in operation whenever required by the State Commissioner of Health.

HERMANN M. BIGGS,
State Commissioner of Health

August 11, 1915

HERMANN M. BIGGS, M.D., *State Commissioner of Health:*

Plans for proposed sewer extensions in the city of Norwich, Chenango county, were submitted to this Department for approval by the city engineer on behalf of the common council on September 7, 1915.

The original plans for a comprehensive sanitary sewer system covering the greater portion of the then village of Norwich were approved on November 18, 1892. Plans for modification and extensions to this sewer system had been approved at different times since the original plans were approved.

In the report on the examination of the plans for proposed sewer extensions in Prospect and Pellett streets, approved on June 16, 1915, the previous actions taken by this Department in reference to sewerage and sewage disposal in Norwich, the condition of pollution of the Chenango river and the reasons why the city should take steps at any early date to provide for at least a partial treatment of the sewage of the city were set forth at some length and will, therefore, not be reviewed at this time. It may be stated, however, that the permits issued in connection with the approval of these plans as well as the plans for proposed sewer extensions in Tillman avenue and Terrace avenue approved on August 11, 1915, contain in addition to the usual revocation and modification clauses the following condition:

> "That on or before October 1, 1916, satisfactory detailed plans for preliminary treatment of the entire sanitary sewage of the city of Norwich by sedimentation accompanied by general plans for additional or supplementary works for more complete treatment of the sewage of the city shall be submitted to this Department for approval and that after approval of said plans such works for preliminary treatment of the sewage shall be constructed and put in operation whenever required by the State Commissioner of Health."

The plans now submitted show that it is proposed to construct some 1,075 feet of 8-inch sewers in Elm street and Francis avenue tributary to the existing sewer in South Broad street, which discharges into the Chenango river through the Birdsall avenue outfall sewer. The proposed sewers are to be constructed on a slope of .6 per cent. Manholes are to be constructed at the upper end of Elm street sewer and at the intersection

of the Elm street sewer with the proposed Francis avenue sewer. Two manholes are to be constructed on the Francis avenue sewer, making the spacing of the manholes on this line not more than 275 feet.

From our examination of the plans it is found that the proposed sewer, if properly constructed, should satisfactorily care for the sanitary sewage of the sections to be served by them and I would, therefore, recommend that the plans be approved and a permit be issued allowing the discharge of sewage, to be collected by the proposed sewers, into Chenango river at the foot of Birdsall street in the city of Norwich. I would further recommend that the permit contain in addition to the usual revocation and modification clauses the same condition with respect to the future disposal of the sewage of the city as that contained in the permits issued to the city on June 16, 1915, and August 11, 1915, which is quoted above.

Respectfully submitted,

THEODORE HORTON,
Chief Engineer

ALBANY, N. Y., *September* 10, 1915

PERMIT

Application having been duly made to the State Commissioner of Health, as provided by section 77 of chapter 49 of the Laws of 1909, the "Public Health Law," as amended by chapter 553 of the Laws of 1911, constituting chapter 45 of the Consolidated Laws, permission is hereby given to the common council of the city of Norwich to discharge sewage from the proposed sewer extensions in Elm street and Francis avenue into the waters of Chenango river at the foot of Birdsall street within the municipality of Norwich in accordance with the plans accompanying the petition, under the following conditions:

1. That this permit shall be revocable at any time or subject to modification or change when in the judgment of the State Commissioner of Health such revocation, modification or change shall become necessary.
2. That the issuance of this permit shall not be deemed to affect in any way action by this Department on any future application that may be made for permission to discharge additional sewage or effluent into the waters of this State.
3. That only sanitary or domestic sewage and no storm water or surface water from streets, roofs or other areas shall be admitted to the proposed sewers.
4. That on or before October 1, 1916, satisfactory detailed plans for preliminary treatment of the entire sanitary sewage of the city of Norwich by sedimentation accompanied by general plans for additional or supplementary works for more complete treatment of the sewage of the city shall be submitted to this Department for approval and that after approval of said plans such works for preliminary treatment of the sewage shall be constructed and put in operation whenever required by the State Commissioner of Health.

LINSLY R. WILLIAMS,
Deputy State Commissioner of Health

September 15, 1915

OGDENSBURG

HERMANN M. BIGGS, M.D., *State Commissioner of Health:*

Plans for proposed sewer extensions in the city of Ogdensburg were submitted to this Department for approval by the city engineer on March 5, 1915.

The plans provide for some 1,500 feet of sewers in Jersey avenue and Hamilton street tributary to the existing 15 and 24-inch sewer in Elizabeth street. Some 300 feet of the upper portion of the proposed sewer between

South and David streets is to be constructed of 8-inch tile pipe laid with a slope of .4 per cent. The remainder of the sewer in Hamilton street and in Jersey avenue is to be a 12-inch sewer with a slope of .4 per cent. Manholes are to be constructed at all points of change of alignment, at the upper end of the sewer and at the intersection of the proposed sewer with the existing Elizabeth street sewer.

It appears from the records on file in this office that the sewage in Patterson street south of Lafayette street formerly discharged into the existing sewer in Elizabeth street. In May, 1913, plans for the interception of the sewers in Patterson street south of Lafayette street and for the discharge of this sewage into a new trunk sewer which was designed to discharge into the St. Lawrence river near Outlet No. 6 were approved. According to the report of the city engineer it is considered by him that the additional discharge of sewage from the proposed sewer in Jersey avenue and Hamilton street will not overtax the Elizabeth street sewers inasmuch as the sewage to be collected by these sewers will not be more than one-third of the amount of sewage which was intercepted from the Patterson street sewer by the construction of the new trunk sewer.

In conclusion I would state that it appears from our examination of the plans that proposed sewers, if properly constructed, should satisfactorily care for the sanitary sewage of the sections to be served by them and I would, therefore, recommend that the plans be approved and a permit be issued allowing the discharge of sewage from the proposed sewers into the St. Lawrence river through Outlet No. 5 at the foot of Elizabeth street.

Respectfully submitted,

THEODORE HORTON,
Chief Engineer

ALBANY, N. Y., *March* 23, 1915

PERMIT

Application having been duly made to the State Commissioner of Health, as provided by section 77 of chapter 49 of the Laws of 1909, the "Public Health Law," as amended by chapter 553 of the Laws of 1911, constituting chapter 45 of the Consolidated Laws, permission is hereby given to the Board of Public Works of the city of Ogdensburg to discharge sewage from the proposed sewer extensions in Jersey avenue and Hamilton street into the waters of St. Lawrence river through existing outfall sewers within the municipality of Ogdensburg in accordance with the plans accompanying the petition, under the following conditions:

1. That this permit shall be revocable at any time or subject to modification or change when in the judgment of the State Commissioner of Health such revocation, modification or change shall become necessary.
2. That the issuance of this permit shall not be deemed to affect in any way action by this Department on any future application that may be made for permission to discharge additional sewage or effluent into the waters of this State.

LINSLY R. WILLIAMS,
Deputy State Commissioner of Health

March 29, 1915

HERMANN M. BIGGS, M.D., *State Commissioner of Health:*

Plans for a proposed sewer extension in the city of Ogdensburg, St. Lawrence county were submitted to this Department for approval by the Board of Public Works on November 6, 1915.

The plans show that it is proposed to construct a sanitary sewer in Spruce street between Mansion and Albany avenues, a distance of about 800 feet. This sewer is to be tributary to the existing combined sewer in Mansion avenue which empties into the tailrace through outlet No. 4 at Main street. This tailrace in turn discharges into the Oswegatchie river below the Lake street bridge.

The proposed sewer is 8 inches in diameter and is to be constructed with a slope of 4 per cent. A manhole is to be installed at the upper end of the sewer and at the junction of the proposed sewer with the existing sewer in Mansion avenue.

From our examination of the plans is would appear that the proposed sewer if properly constructed should satisfactorily meet the needs of the section to be served by it and I would therefore recommend that the plans be approved and a permit be issued allowing the discharge of sewage from the proposed sewer into the Oswegatchie river through outlet No. 4.

Respectfully submitted,

THEODORE HORTON,
Chief Engineer

ALBANY, N. Y., *November* 23, 1915

PERMIT

Application having been duly made to the State Commissioner of Health, as provided by section 77 of chapter 49 of the Laws of 1909, the "Public Health Law," as amended by chapter 553 of the Laws of 1911, constituting chapter 45 of the Consolidated Laws, permission is hereby given to the Board of Public Works of the city of Ogdensburg to discharge sewage from the proposed sewer extension in Spruce street into the waters of the tailrace tributary to the Oswegatchie river at Main street within the municipality of Ogdensburg in accordance with the plans accompanying the petition, under the following conditions:

1. That this permit shall be revocable at any time or subject to modification or change when in the judgment of the State Commissioner of Health such revocation, modification or change shall become necessary.
2. That the issuance of this permit shall not be deemed to affect in any way action by this Department on any future application that may be made for permission to discharge additional sewage or effluent into the waters of this State.

LINSLY R. WILLIAMS,
Deputy State Commissioner of Health

November 26, 1915

OYSTER BAY (North Shore Country Club)

HERMANN M. BIGGS, M.D., *State Commissioner of Health:*

Amended plans for sewage disposal for the North Shore Country Club of Glen Head in the town of Oyster Bay, Nassau county were submitted for approval on April 15, 1915.

These plans were previously submitted for your approval on March 20, 1915, and were carefully examined by the Engineering Division. It was found from this examination that although the proposed sewage disposal plant had been designed to meet the general and local requirements for sewage disposal the disinfection plant should be so modified as to make it more efficient and positive in its operation, and more accessible for cleaning and inspection. The plans were accordingly returned to the Designing Engineer on April 9 with the recommendation that they be modified with respect to the design of the disinfection chamber and that the location of the proposed bathhouses be shown by the plans.

Our examination of the plans now submitted show that they have been revised in accordance with the above recommendations and provide for a covered disinfection or reaction chamber to be located near one corner of the settling tank into which the effluent from the tank is to be discharged. This chamber is to be 3 feet square and 5½ feet deep below the flow line and will give a detention period of about 30 minutes when serving the estimated

future population of 350 persons. Chlorine gas is to be applied to the settling tank effluent at a point 5 feet below the flow line of the chamber. A manhole opening is to be provided in the top of the chamber which will make it accessible for cleaning and inspection.

As noted in our previous report on the examination of the plans first submitted the effluent from the proposed sewage disposal plant is to be discharged into Hempstead harbor at a point some 25 feet from shore at a depth of 2 feet below mean low tide. The point of discharge is about 150 feet from an existing boat house and some 400 feet from a proposed bathing pavilion. In view of the comparatively close proximity of the outlet from the plant to the bathing pavilion and bathing beach not less than 10 parts of chlorine per million parts of sewage should be uniformily applied to the effluent from the settling tanks before it is discharged into Hempstead Harbor.

I would therefore recommend that the plans be approved and a permit be issued allowing the discharge into Hempstead Harbor in the town of Oyster Bay of effluent from the proposed sewage disposal plant on the condition that not less than 10 parts of chlorine per million parts of sewage be uniformly applied to the effluent from the settling tanks before it is discharged into the harbor.

Respectfully submitted,

THEODORE HORTON,
Chief Engineer

ALBANY, N. Y. *April* 16, 1915

PERMIT

Application having been duly made to the State Commissioner of Health, as provided by section 76 of chapter 49 of the Laws of 1909, the "Public Health Law," as amended by chapter 553 of the Laws of 1911, constituting chapter 45 of the Consolidated Laws, permission is hereby given to North Shore Country Club at Glen Head to discharge effluent from the proposed sewage disposal plant on the property of the said country club into the waters of Hempstead Harbor at the point of discharge shown by the plans within the town of Oyster Bay in accordance with the plans accompanying the petition, under the following conditions:

1. That this permit shall be revocable at any time or subject to modification or change when in the judgment of the State Commissioner of Health such revocation, modification or change shall become necessary.
2. That the issuance of this permit shall not be deemed to affect in any way action by this Department on any future application that may be made for permission to discharge additional sewage or effluent into the waters of this State.
3. That both the sewers and the sewage disposal works shown by plans approved this day shall be fully constructed in complete conformity with such plans or approved amendments thereof.
4. That only sanitary or domestic sewage, and no storm water or surface water from grounds, roofs or other areas shall be admitted to the proposed sewers.
5. That no sewage sludge from any part of the disposal works shall be discharged into Hempstead Harbor or any other watercourse or body of water.
6. That not less than ten parts of chlorine per million parts of sewage shall be at all times properly applied to the effluent from the plant.
7. That whenever required by the State Commissioner of Health, satisfactory detailed plans for additional works for more complete treatment of the sewage shall be submitted for approval; and that after approval of said plans any or all portions of such additional or supplementary works for more complete treatment of the sewage shall be constructed and put in operation at such time or times thereafter as said commissioner may designate.

LINSLY R. WILLIAMS,
Deputy State Commissioner of Health

April 19, 1915

OYSTER BAY (Property of H. L. Pratt)

HERMANN M. BIGGS, M.D., *State Commissioner of Health:*

Plans for additions to the sewage disposal plant to treat the sewage from the residence of Herbert L. Pratt, in the town of Oyster Bay, Nassau county, were submitted for your approval by the designing engineers, Waring, Chapman and Farquhar of New York city, on July 26, 1915. A formal application requesting the approval of the plans and permission to discharge the effluent of the proposed disposal works into Long Island Sound near the mouth of Hempstead harbor was received from the engineers on the same date.

The plans submitted for the approval of this Department consist of a tracing and a blueprint thereof showing the general plan of the sewage disposal works together with details of the several structures and also a United States Geological Survey quadrangle topographical sheet on which is indicated the location of the residence of Herbert L. Pratt.

The report of the designing engineer states that under normal conditions the present disposal plant, consisting of a settling tank, dosing tank and subsurface irrigation field, is adequate to dispose of the sewage from the residence, but that at the time of the entertainment of an unusual number of guests the subsurface irrigation field was not able to absorb the increased volume of sewage, with the result that the sewage overflowed the diverting gate chamber. It is therefore proposed to increase the capacity of the plant by building two intermittent sand filters, designed for continued use but which will probably be used only in case the present system is overtaxed, although it is possible that the two systems may be used alternately at weekly intervals.

The residence of Herbert L. Pratt is situated in the western part of the town of Oyster Bay near the mouth of Hempstead harbor, an arm of Long Island Sound. It is stated in the report of the designing engineer that the average number of persons contributing sewage to the disposal plant is 25, and the sand filters are designed for this population and a sewage contribution of 100 gallons per capita per day.

The present system of sewerage and sewage disposal may be briefly described as follows: An 8-inch vitrified pipe sewer conveys the sewage of the residence to the settling tank, which comprises a single compartment provided with a baffle and scum board at the inlet and outlet end respectively and also a baffle 3 feet high at the bottom of the tank and 11 feet 8 inches from the inlet end. The tank is 20 feet by 5 feet in plan and 6 feet deep below the flow line, which gives a capacity of about 4,500 gallons. For a population of 25 and a per capita daily sewage contribution of 100 gallons the average period of detention of the sewage in the settling tank is slightly more than 1.75 days.

From the settling compartment the sewage flows into an adjacent siphon chamber, which has a depth of 30 inches below the siphoning level of the sewage in the siphon chamber. The capacity of the siphon chamber below the maximum level of the sewage in the chamber is 750 gallons, which will cause the siphon to discharge about three times per day.

At present the siphon discharges into a pipe line to a diverting gate, which diverts the sewage into either half of the system of subsurface irrigation tiling, consisting of 3,200 linear feet of "Waring" 6″ x 8″ x 12″ tiles. The absorption area is approximately 0.27 of an acre, which gives a rate of application of the sewage to the area of about 9,260 gallons per acre per day.

It is proposed to build a brick masonry manhole on the present siphon discharge line and to provide a 4-inch cast-iron gate valve, controlling the flow into a new 4-inch vitrified pipe siphon line, which is to be laid on a slope of at least 1 per cent. The new siphon discharge pipe line is to connect with a diverting gate, which will discharge the sewage through either of two 4-inch pipe lines on to one or the other of two sand filter beds. The sewage will discharge onto concrete aprons to prevent displacement of the sand.

The filters are to be formed by excavating to a depth of about four feet and grading the bottom of the excavation into longitudinal valleys in which 4-inch underdrains will be laid with open joints protected at the top by tarred roofing felt. The underdrains will have a grade of about 0.5 per cent and

are to be covered with graded gravel to a minimum depth of three inches. On top of the gravel will be placed three feet of screened sand, divided into two beds of equal area by a central wall.

It is proposed to cover the bed with a 2-inch plank roof supported by 6" x 6" beams resting on 6-inch piers made of 6-inch tile filled with concrete. Over the plank is to be placed two-ply tarred roofing felt and a covering of soil. Each bed is to be 31.25 feet by 17.5 feet in plan, giving a total combined area of .025 acres for the two filters. For a daily sewage contribution of 2,500 gallons the average rate of application of sewage to the beds would be 100,000 gallons per acre per day.

Although open sand filters could probably be operated successfully at a rate of 100,000 gallons per acre per day the proposed rate of operation would be too high for covered filters of this type if they were to be operated continuously. It appears from the report of the designing engineers, however, that the sand filters are to be used only in case of emergency or alternately with the existing subsurface irrigation system. The surface of the beds will in all probability become clogged and the covering or the roof of the filters should therefore be installed in sections in order to facilitate its removal should it become necessary or desirable to clean the surface of the filters.

It is planned to discharge the effluent of the sand filter through a 4-inch vitrified pipe into an 8-inch pipe culvert, which receives the overflow from a spring and surface water through an iron grating in the road. The culvert passes under a driveway and through a stone wall, beyond which it discharges on the sandy beach of Long Island Sound at a point above mean high tide. It is stated in the report of the designing engineers that the ordinary flow from the culvert is absorbed with ten feet of its mouth by the sand of the beach, and it is not expected that the effluent from the sand filters will flow directly into the Sound except at extreme high tide. The effluent if discharged upon the beach would in all probability give rise to objectionable conditions. Under no condition should sewage or sewage effluent be discharged on the surface of the ground in exposed places. In the present case the effluent pipe from the sand filter should be so extended as to be submerged at all stages of the tide.

From our careful examination of the plans is would appear that the proposed sewage disposal plant, if properly constructed and maintained, should in connection with the existing plant satisfactorily care for the sewage from the residence of Mr. Pratt and produce an effluent that may be discharged into Long Island Sound without objection at this time.

I would therefore recommend that the plans be approved and a permit be issued allowing the discharge into Long Island Sound of effluent from the proposed sewage disposal plant on the following conditions:

1. That the effluent pipe from the sand filters be so extended as to be submerged at all stages of the tide.
2. That the cover or roof over the sand filter be installed in sections and so arranged as to facilitate its removal for cleaning the filter beds.

Respectfully submitted,
THEODORE HORTON,
Chief Engineer

ALBANY, N. Y., *July* 31, 1915

PERMIT

Application having been duly made to the State Commissioner of Health, as provided by section 76 of chapter 49 of the Laws of 1909, the "Public Health Law," as amended by chapter 553 of the Laws of 1911, constituting chapter 45 of the Consolidated Laws, permission is hereby given to Herbert L. Pratt to discharge effluent from the proposed disposal plant to treat the sewage from his residence into the waters of Long Island Sound at the point shown by the plan within the town of Oyster Bay in accordance with the plans accompanying the petition, under the following conditions:

1. That this permit shall be revocable at any time or subject to modification or change when in the judgment of the State Commissioner of Health such revocation, modification or change shall become necessary.

2. That the issuance of this permit shall not be deemed to affect in any way action by this Department on any future application that may be made for permission to discharge additional sewage or effluent into the waters of this State.

3. That both the sewers and sewage disposal works shown by plans approved this day shall be fully constructed in complete conformity with such plans or approved amendments thereof.

4. That only sanitary or domestic sewage and no storm water or surface water from grounds, roofs or other areas shall be admitted to the proposed sewers.

5. That the effluent pipe from the sand filters shall be so extended as to be submerged at all stages of the tide.

6. That the cover or roof over the sand filter shall be constructed in sections and so arranged as to be readily removable to facilitate the cleaning of the sand filters when necessary.

HERMANN M. BIGGS,
State Commissioner of Health

August 11, 1915

PATCHOGUE

HERMANN M. BIGGS, M.D., *State Commissioner of Health:*

Plans for a separate system of sewers and sewage disposal works for the village of Patchogue, Suffolk county, covering the whole of the village, were submitted by the board of trustees on September 22, 1915. A formal application for the approval of the plans was received on September 25, 1915.

The records of the Department show that in 1907 an investigation was made by the chief engineer of this Department in regard to the question of water supply and sewerage in the village and it was pointed out at that time that a sewerage system and sewage disposal plant should be installed by the village of Patchogue.

During the investigation made by this Department of the pollution of shellfish grounds the considerable pollution of the Patchogue river and Great South bay by factory wastes and by sewage was noted.

The plans submitted were prepared by Clyde Potts, civil and sanitary engineer of New York city, and comprise duplicate blue prints of the following plans:

1. General plan of sewerage system.
2. Ten sheets showing disposal plant in general and in detail.
3. Nine sheets of profiles of sewers.

The report of the engineer states that the sewage from the village of Patchogue is disposed of through private drains and a sewer in Hammond street and by means of cesspools which give rise to nuisances. It was found to be necessary to pump the sewage from two areas of the village in order to discharge it into the proposed disposal works. The disposal plant is to be located on a plot of ground located between Pine boulevard and Patchogue street, the average height of the plot not being more than 3 feet above high tide. From observations made on the fluctuations of the tide and using mean high tide as a datum it appears that the tide varied during the summer from —1.5 to 0.5. Observations were also made of the flow of the Patchogue river, into which it is proposed to discharge the effluent from the disposal works and it was found that, due to the use of this water for manufacturing purposes, the flow varies from 35,000,000 to 40,000,000 gallons per day during the day time to 7,000,000 to 10,000,000 gallons per day during the night.

The village of Patchogue is situated in the northeastern part of the town of Brookhaven on Great South bay. It is provided with an unfiltered public water supply taken from wells and the works are controlled by the Great South Bay Water Company. The village is provided with private sewers

serving a part of the village and a manufacturing plant and discharging into the Patchogue river at a number of points, the principal point of discharge being at the foot of Hammond street.

The present population of the village, according to the designing engineer, is approximately 4,500. The sewage flow to be expected from the portion of the village to be served by the proposed sewers is estimated at 400,000 gallons per day. The population of the village has shown a steady growth and it is estimated that the ultimate sewage flow from the sewer system will be approximately 800,000 gallons per day.

The plans provide for one outfall which will discharge into the Patchogue river about midway between Pine boulevard and Patchogue street after the sewage has been passed through the disposal plant.

The sewers, which are to range in size from 8 inches to 24 inches, are in nearly every case to be laid on slopes sufficiently steep to provide self-cleansing velocities in the sewers and to prevent clogging, but there are a few instances in which the slopes shown on the plans are low. Among these instances may be mentioned the 12-inch sewer in West Main street from the bridge over the Patchogue river to West avenue, where the slope is only 0.10 per cent. A similar condition is shown in Division street from the bridge to the first manhole east. As the sewers west of the river and the river crossings are not shown on the profiles, although they are shown on the general plan, it would appear that they are not to be built at present. The Patchogue Lace Mill with its 700 employes is located on both banks of the river at East Main street, but as the major part of the buildings are located on the west side it would appear to be important that sewer facilities should be provided for this plant and should, therefore, be shown on the plans. In Bay avenue near Carman street and in Laurel street from West avenue 8-inch sewers are to be laid on slopes of 0.26 per cent. and 0.28 per cent. respectively, but since flush tanks are to be located at the upper ends of these sections, which are not long, it would appear that no trouble should be experienced with clogging of these sewers.

Manholes are to be located at every change of grade or alignment and the maximum spacing between manholes is about 500 feet. Flush tanks are to be located at the upper ends of all laterals with the exception of the sewers in West Main street and Division street mentioned above.

It is necessary according to the design submitted for approval to pump the sewage from two sections of the village. For this purpose 5-inch centrifugal pumps in duplicate, of 300 gallons per minute capacity, actuated by electric motors, are to be used at each pumping plant. An auxiliary gasoline engine is also provided. One pumping station is to be located on Smith street between Rider avenue and Bay avenue and will pump the sewage from the so-called Smith street pumping district through a 6-inch cast-iron force main to a manhole at the corner of Brooke street and Rider avenue, from whence the sewage will flow by gravity to the disposal works.

Sewage from the main pumping district will flow by gravity to the pumping station to be located at the disposal works and will be pumped to the settling tanks.

It is proposed to treat the sewage collected by this system in a sewage disposal plant located on the eastern bank of the Patchogue river between Pine boulevard and Patchogue street. This stream has a drainage area of approximately 14 square miles. The stream is not used for water supply purposes either above or below the point at which the effluent from the disposal works will be discharged into it, but it appears from investigations made by this Department in regard to the pollution of shellfish grounds that Patchogue bay near the mouth of the Patchogue river is used extensively by the oyster industry.

The disposal site is situated within the village limits, but from the photographs submitted by the designing engineer it would appear that the neighborhood it not closely built up and that with efficient operation of the plant no objectionable conditions will be created, at least at the present time.

The sewage will be domestic with the exception of the wastes from the lace mill. Upon reaching the disposal plant the sewage, with the exception of that

from the main pumping district, will discharge directly into the settling tanks. As mentioned above the sewage from the main pumping district will be pumped at the disposal plant to the main outfall sewer to the disposal works. The settling tanks are to be six in number, built of concrete with concrete roof covered by earth. Manholes with covers are to be provided to give access to the tanks. A distributing trough or channel is to extend across both ends of the series of tanks so that the sewage may be discharged into them from either end. Openings controlled by 24-inch slide valves are to discharge the sewage into the tanks. The tanks are to have prismoidal or hopper-shaped bottoms with the low points near the inlet ends and baffles are located just beyond these low points extending from the top of the tank about half way to the bottom of the tank. A wall is located across the center of each tank extending from the bottom to about one foot of the flow line. The six tanks will have a combined capacity equal to about 410,000 gallons, which for the estimated present sewage flow of 400,000 gallons per day will give a period of detention of the sewage in the settling tanks of about 24 hours and for the estimated ultimate flow of 800,000 gallons per day an average period of detention of the sewage in the tank will be about twelve hours.

Openings controlled by valves are located in the bottom of the hopper of each half of each tank through which the sludge may be discharged through a 12-inch cast-iron sludge pipe into the sump of the sludge pump. The sludge is to pass through a screen into the sump well, from which it is to be pumped by means of a centrifugal pump operated by a gasoline engine to the sludge beds. The sludge pump is apparently to have a suction pipe extending into the sump well into which the sewage from the main pumping district is to discharge, probably to act as an auxiliary pump in case of accident to the other two pumps.

The sludge beds are to be two in number and will have a total area of about 6,000 square feet and are to consist of 12 inches of sand laid over 6 inches of broken stone. The beds will be drained through 4-inch underdrains laid in troughs in the bottom of the beds and discharging into an 8-inch main drain which will discharge the effluent of the sludge bed into the 24-inch main outfall sewer to the settling tank.

The effluent from the settling tanks is to pass through a 24-inch outlet to the chlorinating house, where it is to be treated with liquid chlorine. The chlorine is to be applied against the current of sewage as it flows downward through the 24-inch pipe. The report of the designing engineer states that "during a large portion of the year probably 5 pounds of chlorine per day will be sufficient to destroy the intestinal bacteria and give an effluent that would be comparable to an intermittent filter bed effluent and one that would be eminently proper to discharge into the Patchogue river." Five pounds per day for the estimated present sewage flow of 400,000 gallons per day gives a rate of application of about 1.5 parts of chlorine per million, which is very low. A rate of not less than 10 parts per million should be adhered to at all times.

The treated sewage will pass through a chamber where the flow will be measured by means of an automatic registering instrument and will pass through a 14-inch iron outfall pipe into the Patchogue river, where it is to discharge at a point 150 feet beyond the dock line.

The construction of sewers in the areas outside the limits of the incorporated village of Patchogue when done must be done under the provisions of the Town Law by the establishment of a sewer district unless the village limits are extended to include these areas before the sewers shown by the plans outside the village limits are constructed.

In view of the results of our examination of these plans, and after careful consideration of the essential features of the design and of local and general requirements with respect to proper methods for the disposal of sewage from the proposed system of sewers and sewage disposal works, I beg to recommend that these plans be approved and a permit for discharge of effluent from the disposal works into Patchogue river be granted on the following conditions, in addition to the usual revocation and modification clauses:

1. That the grade of the 12-inch sewers in Division street and in West Main street from the river crossing east be increased to not less than 0.15 per cent where the slope is less than this.

2. That not less than 10 parts per million by weight of liquid chlorine be added to the effluent from the sewage disposal works before its discharge into the Patchogue river.

Respectfully submitted,

THEODORE HORTON,
Chief Engineer

ALBANY, N. Y., *October* 21, 1915

PERMIT

Application having been duly made to the State Commissioner of Health, as provided by section 77 of chapter 49 of the Laws of 1909, the "Public Health Law," as amended by chapter 553 of the Laws of 1911, constituting chapter 45 of the Consolidated Laws, permission is hereby given to the board of trustees of the village of Patchogue to discharge effluent from the sewage disposal works to be constructed in connection with the proposed sewer system into the waters of the Patchogue river at the point of discharge shown by the plan within the municipality of Patchogue in accordance with the plans accompanying the petition, under the following conditions:

1. That this permit shall be revocable at any time or subject to modification or change when in the judgment of the State Commissioner of Health such revocation, modification or change shall become necessary.

2. That the issuance of this permit shall not be deemed to affect in any way action by this Department on any future application that may be made for permission to discharge additional sewage or effluent into the waters of this State.

3. That both the sewer system and the sewage disposal works shown by plans approved this day shall be fully constructed in complete conformity with such plans or approved amendments thereof.

4. That only sanitary or domestic sewage and no storm water or surface water from streets, roofs or other areas shall be admitted to the proposed sewers.

5. That no sewage sludge from any part of the disposal works shall be discharged into the Patchogue river, Great South bay, or any other watercourse or body of water.

6. That the gradient of the 12-inch sewer in Division street and in West Main street from the river crossing east be increased to not less than 0.15 per cent, if possible, where the slope is less than this.

7. That not less than 10 parts per million by weight of liquid chlorine be at all times properly added to the effluent from the sewage disposal works before it is discharged into Patchogue river.

Respectfully submitted,

LINSLY R. WILLIAMS,
Deputy State Commissioner of Health

October 22, 1915

PERRY

HERMANN M. BIGGS, M.D., *State Commissioner of Health:*

Plans for the proposed sewer extensions in the village of Perry, Wyoming county, were submitted to this Department for approval by the board of trustees on July 15, 1915.

The village of Perry is located on both sides of Silver Lake outlet about five miles from its junction with the Genesee river. The outlet through a portion of the village and between the village and the Genesee river flows in a comparatively deep and narrow gorge.

The records of the Department show that plans for a comprehensive sewer system covering practically the entire village were approved on September 20, 1900. The plans provided for two outfall sewers into Silver Lake outlet. One of these sewers, serving a greater portion of the village, is located a short distance southeast of the village, and the other outlet, serving Walnut, Handley and one or two other streets, discharges into the Silver Lake outlet about 500 feet below Walnut street. Plans for sewer extensions and for modifications of portions of the sewer system have been approved by the Department from time to time since the original plans were approved.

An inspection of the sewerage conditions of the village was made by a representative of this Department on August 29, 1914. This inspection showed that, although under ordinary conditions there was sufficient flow in Silver Lake outlet to prevent the creation of a nuisance by the discharge of sewage from the village, there were times when this flow was so restricted by the regulating gates on the outlet near the lakes by power development that the flow in the outlet was insufficient to afford adequate dilution for the sewage. The village authorities were therefore advised that steps should be taken to properly regulate the flow in the outlet and that if this were done the time before which it would be necessary to install a sewage disposal plant to treat the sewage of the village might be deferred considerably.

The plans now presented and under consideration show that it is proposed to construct a number of sewers in a newly developed section west of Federal street and in Stainton place and Orchard street west of Center street.

In the section west of Federal street sewers are to be constructed in Silver Lake boulevard, Stanley avenue, Washington street and a street called the Parkway. All of these sewers are to be tributary to the existing sewer in Federal street. The sewers west of Center street are to discharge into the existing sewer in Center street. The proposed sewers are to be 8 inches in diameter and are to be constructed with slopes sufficiently steep to provide self-cleansing velocities in them under ordinary conditions. Manholes are to be placed at all points of change of slope and alignment and flush tanks are to be installed at the upper ends of two of the lateral sewers.

The sewage to be collected by the proposed sewers is to be tributary to the main outfall sewer which discharges into Silver Lake outlet below the village. It would appear from our examination of the plans that the sewers, if properly constructed, should satisfactorily care for the sanitary sewage of the sections to be served by them.

In view of the above, I would recommend that the plans be approved and a permit be issued allowing the discharge into Silver Lake outlet of sewage from the proposed sewer, on condition that steps be taken by the village authorities to so regulate the flow of the Silver Lake outlet as to at all times give sufficient dilution of the sewage to prevent the creation of a nuisance.

Respectfully submitted,

THEODORE HORTON,

ALBANY, N. Y., *August* 3, 1915 *Chief Engineer*

PERMIT

Application having been duly made to the State Commissioner of Health, as provided by section 77 of chapter 49 of the Laws of 1909, the "Public Health Law," as amended by chapter 553 of the Laws of 1911, constituting chapter 45 of the Consolidated Laws, permission is hereby given to the board of trustees of the village of Perry to discharge sewage from the proposed sewer extensions in Silver Lake boulevard, Stanley avenue, Washington street, Parkway, Stainton place and Orchard street into the waters of Silver Lake outlet through existing outlet sewers within the town of Perry in accordance with the plans accompanying the petition, under the following conditions:

1. That this permit shall be revocable at any time or subject to modification or change when in the judgment of the State Commissioner of Health such revocation, modification or change shall become necessary.
2. That the issuance of this permit shall not be deemed to affect in any way action by this Department on any future application that may

be made for permission to discharge additional sewage or effluent into the waters of this State.

3. That only sanitary or domestic sewage and no storm water or surface water from streets, roofs or other areas shall be admitted to the proposed sewers.

4. That steps be taken at an early date by the village authorities to provide for such regulation of the flow through Silver Lake outlet that sufficient water will pass through the outlet to properly dilute the sewage from the village at all times.

HERMANN M. BIGGS,
State Commissioner of Health

August 11, 1915

PINE BUSH (Borden's Condensed Milk Co.)

HERMANN M. BIGGS, M.D., *State Commissioner of Health:*

Plans for works to treat the waste water and washings from the pasteurizing plant of Borden's Condensed Milk Company at Pine Bush in the town of Crawford, Orange county, were submitted for approval on January 15, 1915.

These plans are submitted in accordance with the requirements stated in your letter of December 23, the requirements for submission of plans for works to treat the waste water and washings from the plant having been made as a result of a recent investigation of insanitary conditions caused by the discharge of wastes from this plant into a small stream tributary to Dwaar Kill.

Plans for works to treat the wastes from this plant were first submitted on October 27 and were revised and later submitted on November 7. The plans under consideration were submitted on January 15, 1915.

The wastes to be treated consist of a total of 5,150 gallons per day derived as follows: 400 gallons from cleaning wash room, 100 gallons from cleaning receiving room, 450 gallons from cleaning bottling room, 2,000 gallons from the soaking vat, 500 gallons from the can washing vat, 700 gallons from cleaning pasteurizer and 1,000 gallons from washing floors.

The plans returned on November 18 which had been submitted on November 7 were not satisfactory for final acceptance and the company was advised that they should be modified in the following respects:

1. The proposed cesspool should be omitted.
2. The area of the sprinkling filter should be increased so as to provide for a rate of operation of not more than 30,000 gallons per acre per day per foot of depth of filtering material.
3 The filtering material should not be stratified, should not be less than one inch in size and should be of a more uniform size.
4. The sprinkling filter should be provided with a false floor underdrain system.

The plans submitted have been revised to comply in general with the above specifications.

It is proposed to pass the wastes enumerated above through a settling tank having a capacity of 18,000 gallons, giving 3.6 days' detention, then through a sprinkling filter with an area of .03 of an acre giving a rate of operation of 171,700 gallons per acre per day.

At the outlet end of the settling tank the sewage or effluent is to pass through a pipe outlet on each side to a dosing chamber, one being located on each side of the tank from which dosing chamber the effluent is to be intermittently discharged into a section of the distributing piping over the sprinkling filter. The distributing piping is divided into two sections, each being fed by one of the siphon chambers. The type of nozzle is a Taylor inverted nozzle of the dash plate type. These nozzles are suspended about 2 feet above the surface of the bed. The sprinkling filter is shown by the

plans to be filled to a depth of about 4 feet with broken stone ranging from 1 inch to 2 inches in size.

Accompanying the plans was a full set of putrescibility test results for the various classes of wastes above mentioned.

In the letter transmitting the plans the depth of the sprinkling filter is given as 5 feet although from the elevation marked on the plans it would appear that the depth of this filter is but 4 feet. This is a rather shallow depth for a sprinkling filter of this type and it may be found necessary later to require that the depth of the filter be increased in order to provide proper treatment of the wastes.

Valves are placed on the cross connecting pipe between the distributing systems over the sprinkling filter which would enable the operator, by means of the valve and pipe from the settling tank and the cross connecting pipe above referred to, to discharge into either of the distributing piping systems the flow of effluent from the settling tank.

This flexibility of operation of the plant is of little value except in case of a break down of both siphons since the operation of the siphon chamber is essential for effectively aerating the effluent and distributing it over the sprinkling filter.

The sprinkling filter is provided with a false floor underdrain system made up of horseshoe tiles which discharge into a gutter along the center line of the bed.

The effluent is discharged through 1,100 feet of sewer on a 1 per cent. slope into a creek tributary to Dwaar Kill. It appears, therefore, that the depth of the sprinkling filter could be increased if found necessary later since the slope of the outlet sewer could be lessened.

In view of the above I would recommend that the plans be approved and a permit be issued for the discharge of effluent from the plant into the tributary of Dwaar Kill. I would further recommend that in addition to the usual revocation and modification clause the permit contain a condition that the sprinkling filter be made deeper whenever required by the State Commissioner of Health and a further condition that additional treatment of these wastes be provided for under plans satisfactory to this department should such additional treatment of the wastes be deemed necessary at any time.

Respectfully submitted,

THEODORE HORTON,
Chief Engineer

ALBANY, N. Y., *January* 25, 1915

PERMIT

Application having been duly made to the State Commissioner of Health, as provided by Section 78 of Chapter 49 of the Laws of 1909, the "Public Health Law," as amended by Chapter 553 of the Laws of 1911, constituting Chapter 45 of the Consolidated Laws, permission is hereby given to Borden's Condensed Milk Company to discharge effluent from the proposed works to treat the waste water and washings from the pasteurizing plant of said company at Pine Bush into the waters of a tributary of Dwaar Kill at the point shown by the plans within the town of Crawford in accordance with the plans accompanying the petition, under the following conditions:

1. That this permit shall be revocable at any time or subject to modification or change when in the judgment of the State Commissioner of Health such revocation, modification or change shall become necessary.
2. That the issuance of this permit shall not be deemed to affect in any way action by this department on any future application that may be made for permission to discharge additional sewage or effluent into the waters of this State.
3. That all the waste water and washings from the plant except water containing no organic matter such as the water from the rinsing vat and the cooling water from the pasteurizer shall at all times be passed through the disposal works as shown by the plans.

4. That no sewage or other wastes containing human excreta or washings and no whey, skimmed milk or other wastes containing any considerable amounts of putrescible organic matter shall be passed through the disposal works.

5. That no sludge from any part of the disposal works shall be discharged into the tributary of Dwaar Kill or any other watercourse.

6. That whenever required by the State Commissioner of Health the depth of the sprinkling filters shall be increased and such other changes or additions shall be made to the plant under plans satisfactory to this Department as may be necessary to provide for proper treatment of the wastes.

LINSLY R. WILLIAMS,
February 5, 1915 *Deputy State Commissioner of Health*

PORT CHESTER

HERMANN M. BIGGS, M.D., *State Commissioner of Health:*

Plans for a sewer extension in Madison avenue, in the village of Port Chester, Westchester county, were submitted for approval on July 1, 1913, by the village engineer.

The records of this department show that at the time these plans were originally submitted for approval no action was taken in regard to them in view of the fact that the requirements of this Department relative to the construction of a sewage disposal plant for the village had not been met. Original plans for an intercepting sewer and for sewage disposal plant were approved on April 28, 1911, and amended plans were approved on October 16, 1913 and July 28, 1914. Assurance is given in a letter from the village engineer dated July 29, 1915, that the work of constructing the intercepting and outfall sewers, tunnel and disposal works is well under way and the approval of the sewer extension in Madison avenue is requested.

The plans submitted for approval were prepared by the village engineer and consist of duplicate tracings showing the proposed extension in plan and profile and also details of the proposed sewer appurtenances. The plans show that it is proposed to construct some 800 feet of 8-inch sewer in Madison avenue. The sewer is to be laid on a slope of 0.5 per cent. which should be sufficient to provide a self-cleansing velocity in the sewers and prevent clogging. The sewer is to discharge into an existing 15-inch sewer probably located in North Regent street.

The maximum distance between manholes in the proposed sewer extension is 400 feet and the sewer is straight between manholes, which should provide ample means of inspecting and cleaning the sewer. About 175 feet of the length of the sewer is to be encased in concrete.

From our examination of the plans submitted for approval it would appear that the proposed sewer if properly constructed should satisfactorily care for the sanitary sewage of the section to be served by it and I would, therefore, recommend that the plans be approved and a permit be issued allowing the discharge of sewage from the proposed sewer extension in Madison avenue into Port Chester Harbor near Byram Point on condition that the sewage first be passed through the disposal plant to treat the sewage of the village of Port Chester.

Respectfully submitted,
THEODORE HORTON,
ALBANY, N. Y., *August* 11, 1915 *Chief Engineer*

PERMIT

Application having been duly made to the State Commissioner of Health, as provided by Section 77 of Chapter 49 of the Laws of 1909, the "Public Health Law," as amended by Chapter 553 of the Laws of 1911, constituting

Chapter 45 of the Consolidated Laws, permission is hereby given to the Board of Trustees of the village of Port Chester to discharge sewage from the proposed sewer extension in Madison avenue into the waters of Port Chester Harbor near Byram Point within the municipality of Port Chester in accordance with the plans accompanying the petition, under the following conditions:

1. That this permit shall be revocable at any time or subject to modification or change when in the judgment of the State Commissioner of Health such revocation, modification or change shall become necessary.
2. That the issuance of this permit shall not be deemed to affect in any way action by this department on any future application that may be made for permission to discharge additional sewage or effluent into the waters of this State.
3. That only sanitary or domestic sewage, and no storm water or surface water from streets, roofs or other areas shall be admitted to the proposed sewers.
4. That all the sewage to be collected by the proposed sewer shall before its discharge into Port Chester Harbor be first passed through the disposal plant for the village when such plant is constructed and in operation.

HERMANN M. BIGGS,
State Commissioner of Health

August 11, 1915

RAVENA

HERMANN M. BIGGS, M.D., *State Commissioner of Health:*

Plans for a separate system of sewerage and sewage disposal for the village of Ravena, Albany county, covering all portions of the village, were submitted by the board of trustees on January 19, 1915.

The records of the Department show that several inspections of insanitary conditions at Ravena due to improper sewage discharge into streams have been made by members of the Engineering Division in previous years and that the Chief Engineer addressed a mass meeting held at Ravena to arouse public interest in the movement to provide a modern system of sewerage and sewage disposal for the community.

The plans now submitted were prepared by Morrell Vrooman, consulting engineer, of Gloversville, N. Y., and comprise duplicate prints of the following:

1. A general sewer map showing contours of the ground surface.
2. A general plan of the sewage treatment works.
3. Two sheets showing construction details of the sewage treatment works, one sheet showing a primary settling tank of the Imhoff type and the other showing a sprinkling filter and a secondary settling tank.
4. Two sheets of profiles of sewers.
5. One sheet showing manhole and flush tank details.

The report of the engineer states that the construction of a sewer system in the village is considered necessary by reason of the fact that the soil is clay and leaching cesspools cannot, therefore, be maintained without overflow; that sewage is being discharged from many houses and business places into two small streams passing through nearly the full length of the village; and that offensive and insanitary conditions are present in the village by reason of the lack of sewerage. Furthermore it is proposed to pave Westerlo street, the principal street, running east and west, and it is desired to construct the sewer system and the sewer in this street with house connections to the curb line.

Application is made by the board of trustees for the temporary omission from construction as provided for by section 260 of the Village Law of the sewers shown by the plans in the following streets: Winnie street, Seaberg

street, W., Russell street, south of creek, Street "E," Summit street, Western avenue, from point 250 feet north of Dempster, north to end; Schuyler avenue, and Layman street, together with the sprinkling filter and secondary settling tank of the disposal works.

The village of Ravena is situated in the extreme southeasterly portion of Albany county, about one mile west of the Hudson river. It is provided with an unfiltered, sterilized water supply taken from Hannacroix creek and the works are controlled by the Hannacroix Water Company. The village has no public sanitary sewers, although there are private sewers serving many houses and business places as stated above discharging into two small streams traversing the village and tributary to the Hudson river.

The present population of the village according to the statement of the designing engineer is approximately 1,740. The area of the village, all portions of which are served by the proposed sewers, is 460 acres, giving a density of about 4 per acre. The population of the village has increased from 60 in 1880 to the present population, the village being incorporated in 1914. The growth of population was rapid for a few years when the community was developing into a residence town for railroad men, but there has been little growth in population during the past few years. The Albany branch of the West Shore railroad joins the main line in the village. Based on the present density of population and the probable rate of increase it is estimated that the population ultimately to contribute sewage from the sewer district will be 4,600.

The plans provide for the discharge of effluent from the sewage disposal works into a small stream called Onesquethau creek, which flows into the Hudson at a point above the unincorporated village of Coeymans.

The volume of sewage which may be conveyed to the disposal works by the trunk sewers as designed is about 1,300,000 gallons daily and the sewer system will therefore serve eventually a population of 4,500 to 5,000 on the usual assumptions of sewage contribution. The daily volume of sewage flow for which the sewage disposal works are designed is 210,000 gallons, exclusive of ground water infiltration or the average amount contributed by a population of 2,100. A duplication of each unit of the proposed disposal works is shown by dotted lines on the plans, thus providing for a doubling of the capacity of the plant when necessary in the future.

The sewers range in diameter from 8 inches to 12 inches and the minimum slopes are such as to produce self-cleansing velocities in the sewers. In a few streets where the slope of the sewers is as flat as 0.42 per cent., flush tanks have been provided at the ends of the sewers. The sewer alignment is straight between manholes in all cases and the maximum interval between manholes is 400 feet.

Cast-iron pipe will be used at creek crossings and the specifications provide that in wet trenches sulphur-sand or other similar joint material shall be used. It is stated in the report of the designing engineer that an allowance of but 10,000 gallons per day per mile of sewer for infiltration of ground water has been made since the soil is clay containing little water for the most part and since especial precautions are to be taken to provide as far as possible for watertight joints. The sewage is to be conveyed from all parts of the village to the disposal works by gravity and sewers are shown in all streets of the village.

It is proposed to treat the sewage collected by this system in a sewage disposal plant located at a ravine in the northeasterly portion of the corporation limits at a point about 1,100 feet northerly from Westerlo street. It will be necessary to convey the effluent some 2,000 feet from the plant as noted above, since there is no stream nearer the proposed site. This site was selected according to the report of the designing engineer because, as compared to another favorable location south of Westerlo street, the site to the north of this street is in the corporation limits, the prevailing wind is away from any built up district and the plant can be located in a ravine well out of view from surrounding districts.

The other of the two favorable sites referred to by the engineer would be

south of Westerlo street and would be more desirable than the site selected in the following respects:

1. No long outlet pipe would be necessary, since the effluent could be discharged into a small stream tributary to Hannacroix creek at a point about 1,000 feet above the highest point on Hannacroix creek flowing through a deep gorge at the mouth of this stream.

2. The course of the effluent in flowing to the Hudson river would be through Hannacroix creek, which discharges into the Hudson ¾ mile below the village of Coeymans, while the effluent from the plant, if constructed at the site shown by the plans would discharge into Onesquethau creek (evidently Coeymans creek), which discharges into the Hudson just above the village of Coeymans and passes by several laborers' houses and some brickyards.

Onesquethau creek is evidently the stream shown by the U. S. Geological Survey map to be named Coeymans creek, judging from the location and direction of flow of the stream designated on the plans as Onesquethau creek into which the effluent is to be discharged. Coeymans creek is shown by the Geological Survey map to be formed by Oniskethau creek and Sprayt kill. Coeymans creek at its mouth and near the point of discharge of effluent as proposed, has a drainage area of some 40 square miles. The stream is not used so far as known as a source of public water supply and there are no villages of any considerable size on the watershed above and no sewage is known to be discharged into the stream.

It is apparent that the site selected is suitable as a location for the disposal plant and considering the isolated location of the plant, the shorter length of flow of the effluent in Coeymans creek before reaching the Hudson river as compared to the course of the effluent before reaching the river if discharged into Hannacroix creek and to the fact that the flow of Hannacroix creek, although from a larger watershed than in the case of Coeymans creek, is depleted by its use as a source of water supply for the village, it is believed that the site selected is the better of the two discussed.

It is proposed to admit no roof water and no storm or surface water to the system, which will then convey only sanitary sewage and industrial wastes to the disposal works. There are no factories in operation in the village, the only factory being a cider mill not now in use.

The disposal works are to consist of a screen chamber, a primary settling tank of the Imhoff type, a sprinkling filter, a secondary settling tank also of the Imhoff type, a sludge bed and a chlorination plant.

The screen chamber is a rectangular concrete building 6 feet by 8 feet in plan with a depth below the water table of 6.8 feet. It is housed over with a brick building. A rectangular manhole 2 feet square and 3 feet deep is built against the screen chamber and the outfall sewer discharges into this manhole, the sewage passing into the screen chamber through an opening in the wall 2 feet wide and about 8 inches high. The sewage passes through a bar screen inclined upward with the flow. This screen is 6 feet wide, extends across the entire width of the chamber and is composed of rectangular section bars ⅜ inches by 1½ inches by 4 feet 9 inches spaced 1½ inches apart in the clear by cast iron washers.

From the screen chamber the sewage is carried by a 12-inch pipe to two manholes in series at the end of the settling tank in which manholes it may be possible to divide the flow into equal portions as it enters the tank at two points across the end, although no detail plans of these manholes are shown.

From these two manholes the sewage is to pass into a rectangular horizontal flow primary settling tank of the Imhoff type, 31 feet 3 inches by 18 feet in plan, and having a depth below the flow line of 25½ feet. The sewage is to enter the settling tank at two points through pipes extending through the end wall from the manholes above mentioned. The tank is divided along the central portion of its length into two upper settling compartments and has a total settling compartment capacity of 4,381 cubic feet, or 32,857 gallons. It has two lower sludge compartments having

hopper shaped bottoms. These sludge compartments having a combined capacity of 1,714 cubic feet. The capacity of the settling compartments allows for a detention of sewage of about 3 hours for the volume contributed by a population of 2,100 and the capacity of the sludge compartments will permit of the storage of sludge in the tank from the same population for a period of 6 months. An entrance baffle extends to a depth of 15 inches below the surface across the inlet end about 4 feet from the end wall and a baffle is also placed across the outlet end at a distance of 2 feet from the end wall extending to the same depth below the surface. The effluent from the tank is collected by a trough one foot square extending across the outlet end with a sharp crested weir and is discharged into the effluent chamber adjoining the outlet end of the tank through 3 rectangular openings each 6 inches by 24 inches.

The sludge pipes extend from the bottom of the sludge compartments to the roof of the tank and the discharge pipe leads away from these sludge pipes at an elevation of 5 feet below the surface of the sewage. The sludge from the primary settling tanks is conveyed to a sludge bed 40 feet by 50 feet in area composed of 1 foot of graded crushed stone and 6 inches of filter sand underdrained with 4-inch vitrified pipe spaced 6 inches on centers.

The siphon chamber is 7 feet by 10 feet in plan, inside dimensions, and has a capacity of 1,500 gallons. A partition composed of a screen with a mesh of 2 to the inch is set across the dosing tank about 2 feet from the end wall of the settling tank and a sludge pipe with a 6-inch gate valve leads away from this compartment and connects with a sludge pipe from the settling tank to the sludge bed. The chamber is fitted with a 10-inch siphon which discharges into a channel chamber or narrow compartment adjacent to the siphon chamber from which channel chamber a 6-inch distributing main leads to the sprinkling filters.

From the channel chamber adjoining the dosing tank the effluent is led by a 10-inch pipe to the sprinkling filter distribution system which consists of 3 8-inch branch distributors and 15 lines of 4-inch lateral distributors on which are placed 3-inch riser pipes carrying spray nozzles of which there are 55. The sprinkling filter is constructed of crushed stone and concrete and has an area of 4,370 square feet or about 1/10 of an acre. It has an effective depth of filtering material of 9 feet and operating at the rate of 300,000 gallons per acre per day per foot of depth will care for the sewage contributed by a population of 2,700 on the usual basis of contribution per capita. The sprinkling filter is provided with 6-inch vitrified pipe underdrains spaced 4 feet on centers. The underdrains lead to the central collecting channel or gutter covered by flat concrete slabs.

The operating head from the dosing chamber to the nozzles of the sprinkling filter ranges from a maximum of 6 feet to a minimum of 2 feet 9 inches.

From a manhole adjoining the sprinkling filter the effluent is carried to the secondary settling tank which is circular in plan. This tank is of the Imhoff type and has a downward and upward flow, the effluent being delivered by a pipe to the center of the circular settling compartment and passes downward through this compartment and then upward through twenty-six 6-inch vitrified pipes set through the circular wall of the gas and scum vent at the bottom of this wall which forms one of the vertical partitions of the settling compartment. These 26 pipes open into an annular compartment or outer chamber of the tank from which the sewage flows into a collecting channel surrounding the tank by passing through a second series of pipe openings in the wall. This secondary settling tank has a settling compartment capacity of 10,730 gallons giving a detention of one hour for sewage contributed by the population of 2,100 and has a sludge compartment with a hopper shaped bottom and a capacity of 1,200 cubic feet. From the secondary settling tank the effluent passes through a proposed chlorination plant shown in location upon the plans but for which detailed plans are not shown.

As noted above application is made by the trustees for the temporary omission from construction of the sprinkling filter and final settling tank and it would appear that the application might reasonably be granted in

view of the dilution which will be afforded by the flow in Coeymans creek to the effluent from the plant and to the fact that this stream is not used as a source of public water supply.

The sewer system and sewage disposal works appear to have been carefully designed and are evidently of adequate capacity to serve the present population as well as to provide for some increase in population in the village before the construction of additional works will be necessary.

In view of the results of our examination of these plans and after careful consideration of the essential features of the design and of local and general requirements with respect to proper methods for the disposal of sewage from the proposed system of sewers I beg to recommend that the plans be approved and that a permit be issued allowing the discharge of effluent from the primary settling tank into the waters of Coeymans creek. I would further recommend that this permit if issued be subject to the following conditions in addition to the usual revocation and modification clauses:

1. That whenever required by the Department the additional works including the sprinkling filters, the secondary settling tank and the chlorination plant be constructed and put in operation.

2. That the effluent pipe be extended into Coeymans creek at least ¼ the width of the stream in such a manner as to be submerged at low water stage and that whenever required by this Department the effluent pipe be extended into the Hudson river in accordance with plans satisfactory to this Department.

Respectfully submitted,

THEODORE HORTON,
Chief Engineer

ALBANY, N. Y., *February* 9, 1915

PERMIT

Application having been duly made to the State Commissioner of Health, as provided by section 77 of chapter 49 of the Laws of 1909, the "Public Health Law," as amended by chapter 553 of the Laws of 1911, constituting chapter 45 of the Consolidated Laws, permission is hereby given to the board of trustees of the village of Ravena to discharge effluent from the primary settling tank forming a part of the sewage disposal works to be constructed in connection with the proposed sewer system for the village into the waters of Coeymans creek at the point of discharge shown by the plans within the town of Coeymans in accordance with the plans accompanying the petition, under the following conditions:

1. That this permit shall be revocable at any time or subject to modification or change when in the judgment of the State Commissioner of Health such revocation, modification or change shall become necessary.

2. That the issuance of this permit shall not be deemed to affect in any way action by this Department on any future application that may be made for permission to discharge additional sewage or effluent into the waters of this State.

3. That both the sewer system and the sewage disposal works shown by plans approved this day shall be fully constructed in complete conformity with such plans or approved amendments thereof.

4. That only sanitary or domestic sewage and no storm water or surface water from streets, roofs or other areas shall be admitted to the proposed sewers.

5. That no sewage sludge from any part of the disposal works shall be discharged into Coeymans creek or any other watercourse.

6. That whenever required by the State Commissioner of Health the sprinkling filters, the secondary settling tanks and the chlorination plant shown by plans approved this day shall be constructed and put in operation and that detailed plans for chlorination plant shall be at such time submitted to this Department for approval.

7. That the effluent pipe from the disposal works shall be extended into Coeymans creek at least one-quarter the width of the stream in such a

manner as to be submerged at low water stage; and that whenever required by the State Commissioner of Health the effluent pipe shall be extended into the Hudson river in accordance with plans satisfactory to this Department.

LINSLY R. WILLIAMS,
Deputy State Commissioner of Health

February 15, 1915

BOARD OF TRUSTEES, *Ravena N. Y.:*

GENTLEMEN.— In response to the application made to the State Commissioner of Health under date of January 21, 1915, asking for the approval of said Commissioner to the temporary omission from construction of certain portions of the permanent general system of sewers and sewage disposal for the village of Ravena, plans for which are this day approved by this Department, I hereby certify my determination to approve and do approve of the temporary omission from construction of said portions, to wit: the sewers shown by the plans in the following streets: Winnie street, Seaberg street, W., Russell street south of creek, Street "E," Summitt street, Western avenue from point 250 feet north of Dempster north to end, Schuyler avenue, and Layman street, together with the sprinkling filter and secondary settling tank of the sewage disposal works, until in the judgment of the State Commissioner of Health or of the board of trustees of the village of Ravena the construction of such permanent portions of the sewer system and sewage disposal works may become necessary.

The above approval is given this 16th day of February, 1915, in accordance with Article IX, section 260 of chapter 64 of the Consolidated Laws, the Village Law.

LINSLY R. WILLIAMS,
Deputy State Commissioner of Health

ALBANY, N. Y.

RENSSELAER

HERMANN M. BIGGS, M.D., *State Commissioner of Health:*

Plans for proposed sewer extensions in the city of Rensselaer, Rensselaer county, were submitted to this Department for approval by the city engineer on behalf of the common council on July 27, 1915.

The records of the Department show that plans of a general sewer system of the city, showing all sewers constructed in the city up to May 7, 1903, were not submitted as required by chapter 468 of the Laws of 1903, and that until the present plans were presented no plans for sewers had been submitted to or approved by this Department.

The plans now submitted show that it is proposed to construct comparatively short sewer extensions in Aiken avenue, Spruce street, Ring street, Ninth street, Fourth street, Forbes avenue, Forbes road, Fifth street and Seventh street. The proposed sewer in Aiken avenue is to consist of 1,225 feet of 10-inch sewer and 600 feet of 12-inch sewer tributary to the existing sewer in Aiken avenue, which empties into the Hudson river at the foot of Belmore place extended.

The slope of this sewer is to vary from .5 to 10.8 per cent. The plans also provide for 450 feet of 8-inch sewer in Spruce street and 900 feet of 10-inch sewer in Ring street, tributary to the proposed sewer in Aiken avenue. The sewer in Spruce street is to have a slope of 4.3 per cent and the sewer in Ring street is to have a slope of .5 per cent.

The proposed sewer in Ninth street is to extend to Birch street to the existing sewer in Washington avenue, a distance of 850 feet. This sewer is to have a slope of .5 per cent and is to be tributary to the existing sewer in Washington avenue, which empties into the Hudson river at the foot of Tracey street extended.

The proposed sewers in Fourth street and Forbes avenue are to extend from Patton avenue to Washington avenue, a distance of about 1,120 feet. They are to be 12 inches in diameter and are to be constructed with slopes of from 10.4 per cent to 15.4 per cent. They are to be tributary to the existing sewer in Broadway, which empties into the river at the foot of Tracey street.

The proposed sewer in Forbes road is to extend from a point near Barnett's mill to Central avenue and is to discharge into the Hudson river through a new 15-inch outlet sewer at the foot of Central avenue. It is to be 15 inches in diameter. The upper portion of the sewer is to have a slope of .5 per cent and the lower section 3.4 per cent.

The proposed sewer in Fifth street is to be 10 inches in diameter and is to extend from John street to Partition street, a distance of about 850 feet. The upper portion of the sewer is to have a slope of 7.1 per cent and the lower section a slope of .5 per cent. The proposed sewer in Seventh street is to extend from Harrison avenue to Partition street about 370 feet. It is to be 8 inches in diameter and is to be constructed with a slope of 13.7 per cent. Both of these sewers are to be tributary to the existing sewer in Partition street, which, according to a note on the plans, empties into the Hudson river near the foot of Herrick street.

All of the proposed sewers are to be provided with manholes at all changes of slope and alignment and flush tanks are to be placed at the upper ends of the proposed sewers in Ring and Ninth streets to facilitate flushing and cleaning of the sewers.

It would appear from our examination of plans that the proposed sewers if properly constructed should satisfactorily care for the sanitary sewage of the sections to be served by them. With respect to the discharge of sewage from these sewers into the Hudson river without treatment, it may be stated that it has been the consistent policy of this Department in connection with the approval of all plans for new sewers to require that consideration should be given to the question of future treatment of the sewage before its discharge into any stream or other body of water, especially where public water supplies are involved. With reference to the discharge of sewage into the Hudson river, it may be stated that the city of Albany is now constructing an intercepting sewer and sewage disposal works for the collection and treatment of its sewage before discharging it into the Hudson river, in accordance with plans approved by this Department. The city of Schenectady has recently completed an intercepting sewer and sewage disposal works for the treatment of its sewage before discharging it into the Mohawk river, a tributary of the Hudson river.

Permits recently issued to the cities of Troy and Hudson, located respectively above and below Rensselaer, require that plans for the interception and treatment of the sewage of these cities shall be submitted to this Department for approval. Plans for the disposal of the sewage of the city of Poughkeepsie have already been approved.

The discharge of untreated sewage into the Hudson river from the city of Rensselaer affects not only the city itself but also other municipalities located on the river below the city, some of which take their water supplies from the Hudson river. The Hudson river water is used as a source of supply after filtration for the city of Rensselaer and the intake of the water works is located a short distance above some of the outlet sewers of the city. I am of the opinion therefore that Rensselaer should make a comprehensive study and formulate at an early date a plan for the interception of the sewage of the entire city and of the possible and most appropriate means for the treatment of the sewage and to submit the same to this Department for approval at an early date. In order to do so it will be necessary of course for the city to have a comprehensive plan, showing all existing sewers, prepared.

It is considered a necessity however for the extension of the sewer system of the city as proposed by the plans now submitted, and in view of this necessity I would recommend that the plans for the proposed extension be approved and a permit be issued allowing the discharge into the Hudson river of the sewage to be collected by the proposed sewers without requiring at this

time the submission of plans for interception and preliminary treatment of sanitary sewage of the city before the proposed extensions are constructed, since such requirements would necessarily cause considerable delay in arranging for the desired extensions of the city sewer system.

I therefore recommend that the plans as presented be approved and the matter of submission of plans showing the entire sewer system of the city and providing for interception and treatment of the sewage of the city be held in abeyance.

Respectfully submitted,
THEODORE HORTON,
Chief Engineer

ALBANY, N. Y., *August* 10, 1915

PERMIT

Application having been duly made to the State Commissioner of Health, as provided by section 77 of chapter 49 of the Laws of 1909, the "Public Health Law," as amended by chapter 553 of the Laws of 1911, constituting chapter 45 of the Consolidated Laws, permission is hereby given to the common council of the city of Rensselaer to discharge sewage from the proposed sewer extensions in Aiken avenue, Spruce street, Ring street, Ninth street, Fourth street, Forbes avenue, Forbes road, Fifth street and Seventh street into the waters of the Hudson river through existing outlet sewers and at the points of discharge shown by plans within the municipality of Rensselaer in accordance with the plans accompanying the petition, under the following conditions:

1. That this permit shall be revocable at any time or subject to modification or change when in the judgment of the State Commissioner of Health such revocation, modification or change shall become necessary.
2. That the issuance of this permit shall not be deemed to affect in any way action by this Department on any future application that may be made for permission to discharge additional sewage or effluent into the waters of this State.

LINSLY R. WILLIAMS,
August 20, 1915 *Deputy State Commissioner of Health*

ROCHESTER

HERMANN M. BIGGS, M.D., *State Commissioner of Health:*

Revised plans for sewerage and sewage disposal for the so-called Brighton Sewer District of the city of Rochester, Monroe county, were submitted to this department for approval on January 19, 1915.

General plans for sewerage and sewage disposal for this sewer district to take the place of those approved in 1907 were first submitted for approval on January 15, 1914. The plans were carefully examined by the engineering division and a report was submitted to you under date of January 17, 1914, setting forth the result of this examination and making recommendations for certain revisions, modifications and conditions for the final acceptance of them. The plans were accordingly returned to the city authorities on February 20, 1914, with the recommendation that the following additional plans and information be furnished:

1. Detail plans of the outfall and outlet sewers, including profiles of the same, showing alignments, sizes, slopes and location of manholes should be presented.
2. Detail plans should be submitted of the proposed dosing device, sprinkling filters, final settling basins and sludge beds and such structures should be designed to meet the following requirements:
   (a) The underdrain system of the sprinkling filters should form a false floor.

(b) The area of the sludge beds should be designed to give not less than one-third of a square foot of sludge drying area per person served.

3. The preliminary settling tanks should be designed to give a time of detention of not less than two hours for average or mean conditions of flow.

4. Information and explanations should be submitted as to the utility or necessity for using a detritus tank to treat sanitary sewage.

5. A specific statement should be submitted as to just what storm water enters the sanitary sewers and as to what steps are to be taken to exclude storm water.

6. Storm water inlets to sanitary sewers, if any exist, should be shown upon the plans, as well as provisions by which said storm water will be diverted and disposed of.

7. Data and plans should be submitted with reference to the East Side Trunk Sewer furnishing the following information:

(a) The estimated present and future population served by each section of the East Side Trunk Sewer on the Irondequoit bay watershed.

(b) The location, sizes and capacities of storm water overflows into tributaries of Irondequoit bay.

(c) The extent and frequency of storm water overflowing which occurs under the present conditions and that provided for in the future.

(d) The method which it is proposed to ultimately adopt as a relief measure from these storm overflow conditions.

The plans now submitted were prepared by Mr. John F. Skinner, principal assistant engineer of the city and comprise duplicate copies of the following maps and plans:

Map A — Map of territory showing topography and sewers.
Map B — Situation of plant showing topography.
Map C — Outfall to disposal plant — Winton road and Tryon Park sewer.
Plan 1 — Plan of detritus and screen chamber.
Plan 2. — Plan of adjustable baffles on false bottom of detritus chamber.
Plan 3 — Superstructure of detritus and screen chamber.
Plan 4 — Plan of operating house for settling tanks showing influent and effluent channels and power development.
Plan 5 — Plan for two-celled Emscher settling and digesting tank.
Plan 6 — Plan of sludge bed.
Plan 7 — Plan of sprinkling filter showing half acre unit.
Plan 8 — Plan of pipe connection for sprinkling filter.
Map showing areas tributary to overflows from East Side Trunk Sewer and plans showing details of overflows.

With these plans were also submitted duplicate copies of explanatory and supplemental report by Edwin A. Fisher, consulting engineer to the city of Rochester; duplicate copies of report on the disposal of sanitary sewage in the Brighton Sewer District by John F. Skinner, principal assistant engineer; a copy of the report on the East Side Trunk Sewer by the late Emil Kuichling, consulting engineer, and a copy of the report of the sewage disposal system of Rochester, N. Y., by Edwin A. Fisher, city engineer.

From our examination of these plans and data it appears that the plans have been revised in general accordance with the recommendations of this department and that the required additional data have been furnished.

As noted in our previous report on the examination of the plans submitted in 1914, original plans for the sanitary sewer system in the Brighton Sewer District and for the disposal of this sewage, were approved on October 24, 1907.

The area of the section within the city limit at that time was about 600 acres. The plans, however, were designed to cover an area of about 1,000 acres which additional areas have since been annexed to the city. The original plans provided for the temporary disposal of the sewage by pumping

into the East Side Trunk Sewer in Culver road and for the future treatment of the sewage in a disposal plant consisting of screen chamber, septic tanks, sprinkling filters and final settling basins to be located near Thomas creek.

East side trunk sewer

With respect to the overflow from the East Side Trunk Sewers, it appears from the report of the consulting engineer that there are at present three overflows from this sewer which discharge into tributaries of Irondequoit bay. The first of these overflows is at Atlantic avenue where an overflow weir 24 feet in length discharging into an overflow conduit, 6 feet in diameter, has been constructed. This conduit discharges into Thomas creek and has a capacity of about 460 cubic feet per second. Thomas creek from point of overflow discharges to Winton road, a distance of about 2,000 feet, is a covered channel 12 feet wide and 6 feet high. From the end of this channel to Irondequoit river, a distance of about one mile, Thomas creek flows through what is known as Palmers Glenn owned by the city.

The next overflow to Irondequoit bay is at Garson avenue where there is a 24-foot weir discharging into a conduit 5 feet in diameter which extends through Garson avenue and Merchants road, a distance of about one mile, to the improved channel of Thomas creek. The capacity of this conduit is about 160 cubic feet per second.

The third and last overflow tributary to Irondequoit bay empties into Densmore creek and is located a short distance north of Clifford avenue. The length of the weir at this point is 48 feet. From this point to a point near Waring road, a distance of about 2,100 feet, the channel of Densmore creek has been straightened and a covered concrete channel 5 feet wide and about 8 feet high has been constructed. From this point northerly to a point north of Norton street, a distance of about 3,500 feet, the channel has been straightened and concrete walls constructed. From the end of this improved channel to Irondequoit bay, a distance of about 9,000 feet, the stream follows the natural channel. The capacity of the covered portion of the channel flowing 5½ feet deep is about 900 cubic feet per second.

The following table submitted by the consulting engineer shows the estimated area, population and discharge from the overflow of the East Side Trunk Sewer tributary to Irondequoit bay.

The plans now submitted and under consideration show both the existing and proposed sanitary sewers and storm water sewers in the Brighton District. The storm water sewers discharge at various points into Thomas creek. The sanitary sewers vary in size from 8 to 24 inches and are provided with slopes sufficiently steep to provide self-cleansing velocities under ordinary conditions.

The proposed main outfall sewer is to extend from a point near the existing pumping station at the intersection of Atlantic avenue and Winton road to the sewage disposal plant, a distance of 5,800 feet. The upper 900 feet of the sewer in Winton road is to be 20 inches in diameter and will have a slope of 0.433 per cent. The remainder of the sewer in Winton road, Tryon Park and through city property near the disposal plant is to be 24 inches in diameter and except for the last section near the screen chamber it is to be constructed with a slope of .25 per cent. The last section of the sewer is to have a slope of 2.68 per cent. The capacity of this sewer when flowing full is about 7,400,000 gallons or about 50 per cent. greater than the estimated maximum contribution of sewage from the proposed sewer district.

Detritus and screen chamber

The sewage before reaching the disposal plant is to be passed through a detritus and screen chamber. It is stated by the designing engineer that this chamber has been designed to remove nonputrescible material in the sewage which has been found from experiments to amount to about 1½ cubic yards per 10,000 persons per day inasmuch as this material would not be digested in the Imhoff tank but would add appreciably to the amount of sludge and at the same time tend to clog the needle nozzles of the water wheels, which are to be operated by the flow of sewage. The detritus chamber is divided into three parallel compartments, each of which is to be 4 feet wide and so arranged that either or all of the compartments may be operated at one time. The bottom of each compartment is trapezoidal in form and is to be provided with steel skip having a capacity of about 1 cubic yard. It is proposed to remove the skips when filled with detritus by means of a chain hoist suspended from a traveling crane. The velocity of the flow through the chambers is to be controlled by means of adjustable wooden gratings which will act as false floors through which the detritus may settle to the skips below. At the lower end of the detritus chambers is to be placed a bar screen composed of bars spaced 11/16 of an inch in the clear.

After passing through the screen chamber the sewage will be discharged through some 500 feet of 16-inch cast iron pipe acting as a penstock to Pelton wells located in an operating house at an elevation of about 70 feet below the detritus tanks. There is also to be provided a 12-inch spiral steel riveted pipe extending from the overflow manhole at the screen chamber to the discharge chamber of the operating house. This pipe is to be used in case of stoppage of the water wheels or if for any other reason it becomes necessary to by-pass them. There is also to be a 6-inch connection between a 16-inch force main and 12-inch steel pipe at the operating house by means of which the contents of the 16-inch force main may be blown off into the discharge chamber of the operating house.

Settling tanks

From the discharge chamber of the operating house the sewage is to flow into the influent channels of the settling tanks, which are so arranged that the flow through the tanks may be reversed. Although the screen and detritus chambers to be constructed now are designed to care for the ultimate population of 25,000 people the first unit of the settling tanks to be installed at first has been designed to care for 10,000. When this population is exceeded an additional settling tank is to be installed and the two tanks have been designed to care for the estimated future population of the district. The proposed tank is to be a horizontal flow tank of the Imhoff type and is to be divided by means of partitions into a single upper or settling compartment and two lower cylindrical sludge compartments provided

8. That whenever required by the State Commissioner of Health plans showing a proposed method of relieving overflow conditions of the East Side trunk sewer shall be submitted for approval.

LINSLY R. WILLIAMS,
March 8, 1915 *Deputy State Commissioner of Health*

ROCHESTER STATE HOSPITAL

HERMANN M. BIGGS, M.D., *State Commissioner of Health:*

Plans for water supply and sewage disposal for the so-called Smith Farm of the Rochester State Hospital were submitted to this Department for approval by the State Architect on June 30, 1915.

It was found at the time of the inspection of the sanitary conditions of the hospital in February, 1915, that a small farm known as the Smith Farm adjoining the southeasterly portion of the hospital property had recently been acquired by the hospital. The farmhouse was at that time provided with a well and privy. It was learned that these structures were to be abandoned and that new water supply and sewage disposal systems were to be installed.

The plans now submitted show that it is proposed to construct a 4-inch force main some 1,535 feet long from the pumping station of the so-called deep-well supply of the institution to the farmhouse. "T" connections for future extensions are to be located on the force main and one fire hydrant and lawn hydrant are to be provided. Samples of water for analyses were collected from the deep-well supply at the time of the inspection and the following is quoted from the report on the inspection:

"The water supply appears to be very hard and to be high in nitrates and chlorine and low in bacterial count and free from B. coli. The high chlorine, oxygen consumed and nitrates would ordinarily indicate sewage contamination but the position of the well together with the fact that the ammonias and nitrates are low as well as bacteria, with the absence of B. coli, show clearly that no active contamination occurs."

The superintendent of the hospital, who called at the Department when the plans were presented, stated that the farmhouse is to accommodate seven people and that the soil in the vicinity consists of a top layer of loam from 18 inches to 2 feet deep, below which is a stratum of clay. The plans now presented show that it is proposed to care for the sewage from the farmhouse in a sewage disposal plant consisting of a dry rubble wall cesspool, the effluent from which is to be discharged on the surface of the ground at a point about 345 feet from the cesspool.

The cesspool is to be 7 feet in diameter and 8 feet deep, giving a capacity of about 2,300 gallons. Assuming that the sides of the cesspool would be effective for filtration purposes, the rate of filtration of the sewage through the sides into the soil would be about 150,000 gallons per acre per day. Owing to the probable compact nature of the soil, which is said to consist of loam and clay, there would, in all probability, be a considerable amount of overflow of effluent from the cesspool into the outlet pipe.

The proposed method of discharging this effluent onto the surface of the ground would not be satisfactory and would in all probability create very objectionable conditions. It would be much better to discharge the effluent into a system of subsurface tiling, using not less than 50 feet of tile per person served. The system could, in all probability, be so laid out as to permit of extending the lines of tile if upon operation the system should prove to be inadequate.

The lines of tile should be laid with open joints at a depth of about 12 inches below the surface of the ground and carefully arranged with reference to the topography. Each joint should be properly protected by strips of tar paper, terra cotta caps or other suitable material and the lines of tile

should be covered with layers of graded gravel to prevent the infiltration of soil into the system and its consequent clogging.

In view of the above I would recommend that the plans for water supply and sewage disposal be approved on condition that the effluent from the proposed cesspool be discharged into a subsurface irrigation system consisting of not less than 50 feet of tile per person served and so constructed as to prevent its clogging.

Respectfully submitted,
THEODORE HORTON,
Chief Engineer

ALBANY, N. Y., *July* 14, 1915

The plans were approved on July 27, 1915, on the condition recommended above.

ROME

HERMANN M. BIGGS, M.D., *State Commissioner of Health*:

Amended plans for sewage disposal for the city of Rome, Oneida county, submitted to this Department for approval by the board of water and sewer commissioners on May 7, 1915.

The records of the Department show that plans for a sewage disposal plant consisting of a pumping station, settling tanks of the Imhoff type, sprinkling filters, final settling tanks and auxiliary sludge beds for the disposal of sludge, were approved on September 16, 1911. This sewage disposal plant which has not been constructed, was to be located along the line of the existing outfall sewer about a mile west of the central portion of Rome and the effluent from the plant was to be discharged into Wood creek through the existing outfall sewer near Fort Bull about 1½ miles west of the disposal plant.

The plans now submitted show that it is proposed to extend the existing 40-inch outfall sewer westerly along Wood creek for a distance of 6,950 feet where it is proposed to install a sewage disposal plant. The existing 40-inch sewer has a capacity of about 12,000,000 gallons per day. The proposed extension to this sewer is to be 48 inches in diameter with a slope of 0.05 per cent. and will have a carrying capacity when flowing full of about 20,000,000 gallons. A 36-inch stub is to be constructed at the manhole near the junction of the proposed and existing sewers in order to provide for the construction of a new trunk sewer whenever the capacity of the existing sewer shall have been exceeded.

Wood creek, near the point of discharge from the proposed sewage disposal plant, has a drainage area of about 70 square miles and according to the report of the designing engineer, has a dry weather flow at this point of 30.7 cubic feet per second. Stony creek which has a drainage area of about 22 square miles discharges into Wood creek about 1½ miles west of the disposal plant. The engineer's report states that the flow in Wood creek below this point is about 40 cubic feet per second. It was learned from the office of the city engineer and surveyor, that Wood creek is to be canalized from a point about 6 miles below the disposal plant site to Oneida lake, a distance of about 5 miles and that it is estimated that the canal will increase the flow of Wood creek below this point by about 150 cubic feet per second during the canal season.

The engineer's report states that the population to be served by the proposed sewage disposal plant is equal to about 20,000 persons and that although the water consumption amounts to about 200 gallons per capita per day, the average discharge of sewage at the existing outlet sewer is about 6,000,000 gallons per day with a maximum flow in the spring of about 8,000,000 gallons. This large excess flow is attributed entirely to the infiltration of ground water inasmuch as there are no storm water connections with the city sewer system which has been constructed entirely upon the separate plan.

Sewage disposal

It is proposed to treat the sewage tributary to Wood creek in the sewage disposal plant consisting of a screen chamber, four settling tanks of the Imhoff type, sludge drying beds for the disposal of sludge and a small pumping station to pump the effluent from the sludge beds into the outfall sewer. A Venturi meter is to be installed between the screen chamber and settling tanks for the purpose of recording the flow of sewage. The disposal plant site covers an area of about 20 acres and the plans provide in general for doubling the site of the proposed disposal plant and for the construction of sprinkling filters and final settling tanks in the future to serve a population of 50,000 persons.

Screen chambers

The proposed screen chamber is to be 19 feet long, 4 feet wide and 4 feet 7 inches deep inside dimensions. It is to be provided with an inclined bar screen composed of ⅜-inch by 4-inch wrought iron bars spaced 2½ inches in the clear. The invert elevation of the proposed outfall sewer at the screen chamber is 406.74. The normal creek level at the point of discharge of effluent from the plant is 401.5 and the maximum creek elevation at the same point is 405.5 giving an operating head to the plant of 1.2 feet during maximum high water conditions in the creek.

Settling tanks

From the screen chamber the sewage is to flow into the proposed settling tanks through a 36-inch cast-iron pipe after passing through the Venturi meter. These tanks are divided into four units and the influent and effluent channels are so arranged as to permit of reversing the flow of sewage through the tanks. Each of the four proposed tanks is to be 33 feet wide, 97½ feet long and 26 feet 11½ inches deep inside dimensions and 24 feet 11½ inches deep from the flow line to the bottom of the tank.

Each tank is to be divided by means of reinforced concrete hopper shaped partitions into a single upper settling compartment and four lower hopper shaped sludge compartments. The settling tanks have a combined settling capacity sufficient to give about 2½ hours' detention of the sewage with a daily flow of 8,000,000 gallons. The total capacity of the sludge compartments is equal to 42,000 cubic feet. Each of the sludge compartments is to be provided with an 8-inch sludge pipe and 1½-inch perforated lead water pipe for the purpose of facilitating the removal of sludge.

Sludge drying bed

The sludge from the settling tanks is to be discharged by gravity flow to an adjacent sludge drying bed which is to be divided by means of partitions into 8 units. The bed has a total area of about 10,000 square feet and should be adequate in size to care for the sludge from the population of about 30,000 persons. The sludge bed is to be filled to a depth of from 10 to 14 inches with graded gravel or broken stone supporting a ¼-inch layer of sand. The bed is to be underdrained by means of parallel lines of 3-inch lateral tile pipes spaced 13 feet apart. The effluent from these pipes is to be discharged into an 8-inch main drain which, in turn, discharges into the suction well of the pumping station.

Pumping station

This pumping station, which is to be 8 feet square in plan, is to be equipped with a 3 horse power gasoline motor directly connected with a 4-inch x 5-inch pump. This pump is to discharge into the 36-inch effluent pipe.

Buildings

The plans also provide for a small 6-room brick building to be occupied by the attendant at the plant. A brick barn to be used for the storage of tools and supplies required at the works is also to be constructed on the disposal plant site.

Conclusions and recommendations

From our careful examination of the plans, it appears that the proposed sewage disposal plant, if properly constructed and if operated with care and efficiency should satisfactorily care for the sanitary sewage of the portion of the city tributary to it and should produce an effluent which may be safely discharged into Wood creek at this time without objection.

In view of the above, I would recommend that the plans be approved and a permit be issued allowing the discharge into Wood creek of effluent from the proposed sewage disposal plant within the city of Rome and that the permit contain in addition to the usual revocation and modification clauses the condition that whenever required by the Commissioner of Health, plans for more complete treatment of the sewage shall be submitted to this Department for approval.

Respectfully submitted,

THEODORE HORTON,
Chief Engineer

ALBANY, N. Y., *May* 20, 1915

PERMIT

Application having been duly made to the State Commissioner of Health, as provided by section 77 of chapter 49 of the Laws of 1909, the "Public Health Law," as amended by chapter 553 of the Laws of 1911, constituting chapter 45 of the Consolidated Laws, permission is hereby given to the board of water and sewer commissioners of the city of Rome to discharge effluent from the proposed sewage disposal works to be constructed in connection with the proposed outfall sewer extension into the waters of Wood creek at the point shown by the plans within the municipality of Rome in accordance with the plans accompanying the petition, under the following conditions:

1. That this permit shall be revocable at any time or subject to modification or change when in the judgment of the State Commissioner of Health such revocation, modification or change shall become necessary.
2. That the issuance of this permit shall not be deemed to affect in any way action by this Department on any future application that may be made for permission to discharge additional sewage or effluent into the waters of this State.
3. That both the outfall sewer extension and the sewage disposal works shown by plans approved this day shall be fully constructed in complete conformity with such plans or approved amendments thereof.
4. That only sanitary or domestic sewage, and no storm water or surface water from streets, roofs or other areas shall be admitted to the proposed sewage disposal works.
5. That no sewage sludge from any part of the disposal works shall be discharged into Wood creek or any other watercourse.
6. That whenever required by the State Commissioner of Health, satisfactory detailed plans for additional works for more complete treatment of the sewage of the city of Rome shall be submitted for approval and upon approval of said plans any or all portions of such additional or supplementary works for more complete treatment of sewage shall be constructed and put in operation at such time or times thereafter as said Commissioner may designate.

LINSLY R. WILLIAMS,
Deputy State Commissioner of Health

May 27, 1915

SANTA CLARA (Saranac Inn)

HERMANN M. BIGGS, M.D., *State Commissioner of Health:*

Plans for additions to the sewage disposal plant at the Saranac Inn Hotel on Upper Saranac Lake in the Town of Santa Clara, Franklin county, were submitted for approval on November 22, 1915.

The plans were prepared by J. L. Collins, civil and hydraulic engineer, New York City and comprise duplicate copies of three black prints on cloth showing general lay-out and details of the disposal works. According to the report submitted by the engineer the population at the hotel ranges from 40 to 50 during the winter with a maximum of 400 for a couple of months during the summer.

It appears that the present disposal plant consists of a septic tank, storage tank pumping station, subsurface irrigation system and sludge drying bed and that the irrigation system is inadequate to properly care for the sewage during the summer. It is therefore, proposed to use the present plant during the winter and to pump the effluent from the existing settling tank during the summer to the proposed dosing tank and sand filter to be located about 2,000 feet beyond the present subsurface irrigation system. The capacity of the settling and storage tanks is 28,000 gallons. The force main through which the clarified sewage is to be pumped is to be 4 inches in diameter and is to consist of universal cast-iron pipe.

The report states that the pumps have a capacity of from 40 to 60 gallons per minute and that the sewage will be pumped for a period of from 8 to 12 hours each day beginning at 7 o'clock in the morning. It is stated that the water consumption amounts to about 28,000 gallons per day but that the sewage disposal plant is based on a flow of sewage of 42,000 gallons per day which is a little more than 100 gallons per capita.

The proposed dosing tank is to be rectangular in plan 20 feet long, 8 feet wide and 6 feet deep inside dimensions. It is to be equipped with two 6-inch alternating siphons of the Miller type designed to draw 5 feet. These siphons will discharge alternately to the two proposed sand filters and each dose will flood one of the sand filters to a depth of a little more than ¾ of an inch.

Each filter is to be 120 feet by 100 feet and is to be filled to a depth of about 4 feet with a medium grade of sand. The combined area of the two beds is .55 acres and the beds will, therefore, be required to operate at an average rate of 73,000 gallons per acre per day when serving a population of 400, assuming a daily rate of sewage contribution of 100 gallons.

Each bed is to be provided with a distributing system consisting of troughs equipped with adjustable gates for regulating the flow of sewage. The underdrain system is to consist of 4-inch laterals connected with the 8-inch main underdrain. These underdrains are to be covered with 12 inches of graded broken stone.

It is proposed to discharge the effluent from the sand filters into a ravine which leads to a low swampy area. It appears from the plans that this swamp has no outlet. According to the report of the engineer this swamp is located on the hotel property far from any buildings and it is not considered by him that any objectionable conditions will be created by the discharge of effluent into the swamp owing to its isolated location. He states, however, that in case any objectionable conditions should arise an additional dosing tank and sand filter similar to the one to be constructed now, may be installed and the location of this additional plant is shown on the plans.

From our careful examination of the plans, it would appear that the proposed disposal plant, if properly constructed and operated with care and efficiency should satisfactorily care for the sanitary sewage of the hotel during the summer months.

I would therefore recommend that the plans be approved and a permit be issued allowing the discharge of effluent into the swamp at the point of discharge shown by the plans on condition that whenever required by this Department the additional sand filters shown by the plans, shall be constructed and put in operation.

Respectfully submitted,
THEODORE HORTON,
Chief Engineer

ALBANY, N. Y., *December* 8, 1915

PERMIT

Application having been made to the State Commissioner of Health, as provided by section 76 of chapter 49 of the Laws of 1909, the "Public Health Law," as amended by chapter 553 of the Laws of 1911, constituting chapter 45 of the Consolidated Laws, permission is hereby given to Upper Saranac Association to discharge effluent from the proposed sewage disposal works to treat the sewage from Saranac Inn into the waters of a swamp at the point of discharge shown by the plans within the Town of Santa Clara in accordance with the plans accompanying the petition under the following conditions:

1. That this permit shall be revocable at any time or subject to modification or change when in the judgment of the State Commissioner of Health such revocation, modification or change shall become necessary.
2. That the issuance of this permit shall not be deemed to affect in any way action by this Department on any future application that may be made for permission to discharge additional sewage or effluent into the waters of this State.
3. That both sewers and sewage disposal works shown by plans approved this day shall be fully constructed in complete conformity with such plans or approved amendments thereof.
4. That only sanitary or domestic sewage and no storm water or surface water from grounds, roofs or other areas shall be admitted to the proposed sewers.
5. That no sewage sludge from any part of the disposal works shall be discharged into the swamp or into Saranac lake or any other watercourse or body of water.
6. That whenever required by the State Commissioner of Health satisfactory detailed plans for additional works for more complete treatment of the sewage from Saranac Inn shall be submitted for approval; and upon approval of said plans any or all portions of such additional or supplementary works for more complete treatment of sewage shall be constructed and put in operation at such time or times thereafter as said Commissioner may designate.

LINSLY R. WILLIAMS,
Deputy State Commissioner of Health

December 14, 1915

SARANAC LAKE

HERMANN M. BIGGS, M.D., *State Commissioner of Health:*

Amended plans for sewer extensions in the village of Saranac Lake, Essex and Franklin counties, were submitted to this Department for approval by the sewer commissioners on October 28, 1914. Application for the approval of the plans and issuance of a permit was received on November 10.

The records of the Department show that original plans for sewerage for the village were approved on October 17, 1892. Plans for modifications and extensions to this sewerage system have been approved from time to time since the original approval was given. On June 20, 1912, plans for extensions in two districts, one in the southeastern and the other in the western part of the village which had recently been annexed to the village, were approved. The permit issued in connection with the approval of these plans contains in addition to the usual revocation and modification clauses the following conditions:

1. That only sanitary or domestic sewage and no storm water or surface water from streets, roofs or other areas shall be admitted to the proposed sewers.
2. That on or before March 1, 1913, satisfactory detailed plans for preliminary purification or clarification by sedimentation of the entire sanitary sewage of the village of Saranac Lake, accompanied by general

plans for additional or supplementary works for more complete treatment of the sewage, shall be submitted to this Department for approval; and that after approval of said plans such works for preliminary purification of such sewage shall be constructed and put in operation within the time limit then specified.

Plans for sewage disposal as required by the above permit have not been received, however, and when the present plans were submitted the village authorities were advised that no action could be taken on the plans until the question of the submission of plans for sewage disposal for the village had been disposed of. An application for an extension of the time for filing such plans was subsequently received from the sewer commissioners under date of December 18, 1914, and on December 21 the time for filing plans for sewage disposal was extended from March 1, 1913, to December 1, 1916.

The plans now presented provide for slight modifications in the plans approved in 1912 and contain more details than the approved plans. It appears from the report of the engineer who designed the plans that when the original plans were approved the needs for the immediate construction of sewers in the districts to be served by them were so urgent that a detailed topographical map of the sewer districts could not be prepared. Since that time topographic surveys of the districts have been made and detailed plans on a larger scale prepared.

It appears from our examination of these plans that although the alignment and location of the proposed sewers are to be practically the same as originally planned, changes have been made in the slopes of certain of the lateral sewers. The size of the sewer through private property east of Flower avenue has also been increased from 6 to 8 inches in diameter and the slope of the greater portion of this sewer has been decreased from .6 per cent. to .4 per cent. I am of the opinion that the proposed changes should not decrease the efficiency of these sewers.

The upper section of the proposed sewer in Flower avenue near Turtle pond shown by the original plans is to be omitted. It appears from the more detailed plans now submitted that the topography of this section is such that the upper section of this sewer some 650 feet long cannot be extended as far south on Flower avenue as shown by the plans approved in 1912. The short section of sewer in the State road south of Algonquin avenue shown by the approved plans is also omitted.

No changes are to be made in the 10, 12 and 15-inch trunk sewers in one of the sewer districts. As noted in my report on the examination of the original plans these sewers are to be constructed with minimum slopes. It is my opinion, therefore, that these particular sewers should be carefully constructed and properly maintained. They should be inspected and flushed regularly and at frequent intervals.

In conclusion I would state that it appears from our examination of the plans that the sewers shown by them if properly constructed and maintained should satisfactorily care for the sanitary sewage of the districts to be served by them. I would therefore recommend that the plans be approved and a permit issued allowing the discharge into Saranac river of sewage to be collected by the proposed sewers on the condition that detailed plans for preliminary treatment by sedimentation of the entire sanitary sewage of the village together with general plans for supplementary or more complete treatment of such sewage be submitted for approval on or before December 1, 1916.

Respectfully submitted,
THEODORE HORTON,
Chief Engineer

ALBANY, N. Y., *January 5, 1915*

PERMIT

Application having been duly made to the State Commissioner of Health, as provided by section 77 of chapter 49 of the Laws of 1909, the "Public Health Law," as amended by chapter 553 of the Laws of 1911, constituting

chapter 45 of the Consolidated Laws, permission is hereby given to the sewer commissioners of the village of Saranac Lake to discharge sewage from the proposed sewer extensions in Algonquin avenue and other streets into the waters of Saranac river through existing outlet sewers within the municipality of Saranac Lake in accordance with the plans accompanying the petition, under the following conditions:

1. That this permit shall be revocable at any time or subject to modification or change when in the judgment of the State Commissioner of Health such revocation, modification or change shall become necessary.
2. That the issuance of this permit shall not be deemed to affect in any way action by this Department on any future application that may be made for permission to discharge additional sewage or effluent into the waters of this State.
3. That only sanitary or domestic sewage and no storm water or surface water from streets, roofs or other areas shall be admitted to the proposed sewers.
4. That on or before December 1, 1916, satisfactory detailed plans for preliminary purification or clarification by sedimentation of the entire sanitary sewage of the village of Saranac Lake, accompanied by general plans for additional or supplementary works for more complete treatment of the sewage shall be submitted to this Department for approval; and that after approval of said plans such works for preliminary purification of such sewage shall be constructed and put in operation within the time limit then specified.

LINSLY R. WILLIAMS,
Deputy State Commissioner of Health

January 5, 1915

SAUGERTIES

HERMANN M. BIGGS, M.D., *State Commissioner of Health:*

Plans for modifications and extensions to the sewer system of the village of Saugerties, Ulster county, were submitted to this Department for approval by the board of sewer commissioners on January 5, 1915.

The village of Saugerties, which has a population of about 4,000 persons according to the 1910 census, is located on Esopus creek and the Hudson river near the confluence of these two streams. The records of the Department show that original plans for sewerage and sewage disposal for the village were approved on December 17, 1902. These plans provided for a comprehensive sewer system covering practically the entire village. The greater portion of the system is designed on the separate plan but it appears that it was planned to admit storm water from an area of about 150 acres to the proposed sewers. These plans provided for five outlets into Esopus creek. The dry weather flow of sewage tributary to three of the outlets serving the greater portion of the village was to be cared for in three separate sewage disposal plants consisting of grit chambers and single compartment septic tanks. Two of the outlets serving some eight houses in the lower part of the village were planned to discharge directly into the creek without treatment. The disposal plants which have been constructed and are now in operation were designed to care for a population of about 6,000 persons on the basis of a per capita rate of sewage contribution of 100 gallons per day.

The plans now before the Department and under consideration provide for an extension of the Elm street sewer, for a modification of a section of the sewer in Elm street north of the flush tank above Dawes street and for a connection of the proposed sewers with one of the outlet sewers of the village. The proposed sewer in Elm street is to consist of some 400 feet of 8-inch sewer to be laid on a slope of .7 per cent. The section of the sewer to be modified is 429 feet long and is to consist of an 8-inch sewer laid on a slope of .3 per cent. The original plan provided for a 6-inch sewer in this section of Elm street. A flush tank is to be constructed at the upper end of both sections of these sewers.

The outlet of the proposed sewer is to be constructed across private property and is to extend from Elm street to Market street where an 8-inch sewer laid on a .3 per cent. slope is to be used; and from Market street to the outlet sewer at Washington street where a 10-inch sewer with a slope of .24 per cent. is to be constructed. Except near Market street manholes are to be constructed at all changes of slope and alignment of the sewers and at sewer intersections. A lamphole is provided at Market street and although it would be better to construct a manhole at this point, it is probable that, owing to the short length of the section of the sewer below the manhole, which is only some 25 feet long, no difficulty will be experienced from cleaning this section of the sewer in case of stoppage.

It appears from the plans that the proposed sewers, with one exception, are to be constructed with minimum slopes for the sizes of sewers shown. Although flush tanks are to be constructed at the upper ends of the two sections of the sewer in Elm street special precaution should be taken both in the construction and maintenance of the sewers in order to prevent clogging owing to the comparatively flat slopes of the sewers. It is also found from the plans that the sewers are for the most part to be laid in shallow trenches. Precautions should be taken in the construction of the sewers to protect them from freezing and breakage where the covering is less than three feet over the top of the sewer.

The proposed sewers are to be tributary to the disposal plant near the lower Dock road. The additional amount of sewage made tributary to the plant by the construction of the proposed sewers will be comparatively small and it would appear that if the sewage disposal plant was constructed in accordance with the approved plans the septic tank is of sufficient capacity to care for the extra amount of sewage provided for without overtaxing the plant.

I would recommend, therefore, that the plans be approved and a permit be issued allowing the discharge into Esopus creek of sewage from the proposed sewers after such sewage shall first have been passed through the sewage disposal plant near the lower Dock road.

Respectfully submitted,
THEODORE HORTON,
Chief Engineer

ALBANY, N. Y., *January* 12, 1915

PERMIT

Application having been duly made to the State Commissioner of Health, as provided by section 77 of chapter 49 of the Laws of 1909, the "Public Health Law," as amended by chapter 553 of the Laws of 1911, constituting chapter 45 of the Consolidated Laws, permission is hereby given to the sewer commissioners of the village of Saugerties to discharge sewage from the proposed sewer extensions in Elm street and the proposeed connection with the Washington street outfall sewer into the waters of Esopus creek through the existing outfall sewer within the municipality of Saugerties in accordance with the plans accompanying the petition, under the following conditions:

1. That this permit shall be revocable at any time or subject to modification or change when in the judgment of the State Commissioner of Health such revocation, modification or change shall become necessary.
2. That the issuance of this permit shall not be deemed to affect in any way action by this Department on any future application that may be made for permission to discharge additional sewage or effluent into the waters of this State.
3. That all the sewage to be collected by the proposed sewers shall before its discharge be first passed through the sewage disposal plant near the lower Dock road.

LINSLY R. WILLIAMS,
Deputy State Commissioner of Health

January 13, 1915

SCARSDALE (Sewer District No. 1)

HERMANN M. BIGGS, M.D., *State Commissioner of Health:*

Detailed plans for proposed sewers in Sewer District No. 1 of the town of Scarsdale, Westchester county were submitted to this Department for approval by the sewer commissioners of the district on January 16, 1915.

Original plans for a comprehensive sewer system covering practically the entire district were approved on December 27, 1913. The design of the sewers in certain undeveloped tracts in this sewer district had not been worked out in detail on the original plans and detailed plans for sewers in a number of such tracts have been submitted for approval from time to time since that date in accordance with one of the conditions on which the original plans were approved.

The plans submitted now comprise detailed plans of proposed sewers in one of these tracts known as Edgewood and designated on the original plans as Chelton Park. This tract comprises an area of some 40 acres located in the southern part of the sewer district. Only the western portion of the property is to be provided with sewers, however, as the eastern section of Edgewood is outside the boundary line of the district.

The proposed sewers provided for by the plans comprise comparatively short extensions in Tunsdall place, Barry place, Edgewood place and Davis place, all of which are to be tributary to the existing outfall sewer which discharges into the Bronx Valley sewer at manhole No. 64. These extensions are to be 8 inches in diameter and are to be constructed with slopes varying from .74 per cent. to 2.74 per cent. Manholes are to be installed at all points of change of alignment of the sewers and the maximum spacing between manholes is to be less than 500 feet. An automatic flush tank is shown at the upper end of all of the proposed sewers except in the case of the short 135-foot section in Edgewood place which is to be provided with a manhole.

From our careful examination of the plans it appears that the proposed sewers if properly constructed should satisfactorily care for the sanitary sewage of the section of the district to be served by them and I would therefore recommend that the plans be approved.

Respectfully submitted,

THEODORE HORTON,
Chief Engineer

ALBANY, N. Y., *January* 19, 1915

The plans were approved January 21, 1915.

HERMANN M. BIGGS, M.D., *State Commissioner of Health:*

Plans for proposed sewers in Sewer District No. 1, town of Scarsdale, Westchester county, were submitted to this Department for approval by the sewer commissioners of the district on March 26, 1915.

Original plans for a proposed sanitary sewer system covering practically the entire district were approved on December 27, 1913. The design of the sewers in certain undeveloped sections of this sewer district had not been worked out in detail on the original plans and the plans were therefore approved on condition "that before the construction of any sewers for which full details of design are not shown by the plans satisfactory detailed plans of such sewer shall be submitted to this Department for approval."

The plans now presented were submitted in accordance with the above requirements and comprise detailed plans of proposed sewers in Montrose road, Valley road, Gorham place, Kevlin avenue, Sage terrace north, Sage Terrace south, Butler place, Brewster road, and through private property between Brewster road and Brite avenue in the Scarsdale Hill section in the northerly part of the sewer district. The proposed sewers are all to be eight inches in diameter and are for the most part to be constructed with fairly steep slopes, although in a few instances the sewers are planned with minimum slopes. Manholes are to be installed at all changes of slope and alignment and the maximum spacing between adjacent manholes does not exceed 400 feet. Flush

tanks are also to be installed at the upper ends of most of the lateral sewers. All of the proposed sewers are tributary to the Fenimore Avenue trunk sewer, which discharges into the Bronx Valley sewer at manhole No. 53. The datum plan shown by the present plans is 146.33 feet above that shown on the general plan approved in 1913.

From our careful examination of the plans it is found that the proposed sewers if properly constructed should satisfactorily care for the sanitary sewage of the section of the sewer district to be served by them, and I would therefore recommend that the plans be approved.

Respectfully submitted,

THEODORE HORTON,
Chief Engineer

ALBANY, N. Y., *March* 27, 1915

The plans were approved on March 29, 1915.

HERMANN M. BIGGS, M.D., *State Commissioner of Health:*

Detailed plans for proposed sewers in Sewer District No. 1 of the town of Scarsdale, Westchester county, were submitted to this Department for approval by the sewer commissioners on June 17, 1915.

Plans for a comprehensive sanitary sewer system for this district were approved on December 27, 1913. Although these plans covered practically the entire district the design of the sewers in certain undeveloped sections of the district had not been worked out in detail. The plans were accordingly approved on the condition that before the construction of the sewers not shown in detail plans showing details of such sewers be submitted for approval.

The plans now presented were submitted in accordance with the above requirement and show details of the proposed sewers in the northeastern section of the sewer district adjacent to the village of White Plains and also provide for extensions to the sewers and modifications of the plans for sewers in the Popham tract of the sewer district.

The sewers in the northeastern section of the sewer district will serve an area of about 125 acres and are to be tributary to one of the existing trunk sewers which discharges into the Bronx Valley Trunk Sewer at manhole No. 64. The proposed sewers are to be constructed in the New York and White Plains Post road and in Oxford, Cambridge, South Prescott, Park, Garden, Woodland and Cushman roads, and through private property between Oxford road and Cushman road. All of the sewers except the 10-inch so-called intercepting sewer through private property are to be 8 inches in diameter and are to be constructed with rather steep slopes. Manholes are to be provided at all points of change of slopes and alignment and at intermediate points on straight alignments more than 500 feet apart. A flush tank is to be installed at the upper end of most of the lateral sewers.

Some 2,700 feet of the upper portion of the so-called 10-inch intercepting sewer is shown with a slope of 0.2 per cent. According to the plans and application submitted with them, it appears that this sewer crosses a "divide" where the depth of the sewer will exceed 20 feet for a distance of about 600 feet and a depth of 28 feet for a short distance and that for these reasons the sewer has been designed with a rather flat slope of .2 per cent in order to avoid excessive deep cutting or excavation through rock. Although the proposed slope is flatter than desirable for a sewer of this size, the spacing of the manholes is, with one exception, comparatively close and each of the four lateral sewers tributary to it is to be provided with a flush tank. I am of the opinion that with these facilities for inspecting, flushing and cleaning there should be no serious difficulty from clogging in this portion of the sewer provided it is carefully constructed and maintained.

Detailed plans for sewers in East and West parkways, and in Popham, Chase, Meadow and Crane roads in the Popham tract were approved on October 13, 1914. The plans now presented are to supersede the plans approved last year and provide for a slight modification of the sewer in Meadow road and in

East and West parkway, for a short extension in the westerly portion of East and West parkway and for some 500 feet of sewer through private property between Fox Meadow road and Church lane. The sewers which are to be tributary to the main sewer which discharges into the Bronx Valley Sewer between manholes Nos. 76 and 77 are to be 8 and 10 inches in diameter and are all to be constructed with comparatively steep slopes. Manholes are to be installed at all changes of alignment and slope and on straight alignments at intervals of less than 500 feet.

In conclusion I would state that it is found from our examination of the plans that the proposed sewers, if properly constructed and maintained, should satisfactorily care for the sanitary sewage of the tracts to be served by them and I would, therefore, recommend that the plans be approved.

Respectfully submitted,

THEODORE HORTON,
Chief Engineer

ALBANY, N. Y., *June* 30, 1915

The plans were approved on July 1, 1915, in accordance with the above recommendation.

SUFFERN

HERMANN M. BIGGS, M.D., *State Commissioner of Health:*

Amended plans for sewerage and sewage disposal for the village of Suffern, Rockland county, were submitted to this Department for approval on December 30, 1914.

These plans were first submitted for approval on August 24, 1914, and were given careful examination by the Engineering Division. A report setting forth the results of the examination and making recommendations for certain modifications in the plans before the final acceptance of them was submitted to you under date of September 9, 1914. The plans were accordingly returned to the designing engineer with the recommendation that they be revised in accordance with the following conditions:

1. That the slopes of all portions of the sewers in Orange avenue and C street be increased to not less than 0.35 per cent.
2. That the sewers in the following streets to be shown by the plans be constructed in cast-iron pipe: In Wayne and Lake avenues east of Washington avenue, in Pleasant avenue, in Washington avenue north of Pleasant avenue, in the lower sections of the lane near the railroad, in the lower section of Utopian avenue, in Wayne avenue between Lake avenue and F street, and the sewer along the lake between Pleasant avenue and the railroad.
3. That auxiliary power or pumping equipment in addition to that shown by the plans be added to the Lake Avenue pumping station.
4. That detailed plans for the chlorination plant be submitted for approval.

It was also pointed out in the report that owing to the urgent necessity for removing outside privies and cesspools from the bank of Lake Antrim and thereby removing these sources of possible contamination of the village water supply it would be desirable to so modify the design of the portion of the sewer system adjacent to Lake Antrim as to permit of constructing sewers near the lake before the major portion of the sewer system would be installed. This recommendation with reference to modifying the plan however has been carried out. It appears from the plans that such modifications to the sewer system could be made with reasonable economy, and I would recommend that the village authorities be urged to give this matter serious consideration. They should be advised, however, that before any modifications are made in the construction of the sewer system as shown by the plans that such modifications should be submitted to this Department for approval.

From our examination of the plans now submitted it is found that except as noted they have been revised in accordance with all the recommendations

enumerated above. The slopes of the 8-inch sewers in Orange avenue and C street have been increased to .35 per cent and cast-iron pipe is to be substituted for vitrified tile pipe in the streets near Lake Antrim as required. The plans also show an auxiliary pumping equipment consisting of an additional centrifugal pump to be driven by a separate engine at the Lake Avenue pumping station in addition to the duplicate centrifugal pumps and electric motors comprising the pumping equipment originally planned for.

Detailed plans of the chlorination plant to be constructed in connection with the so-called Chestnut Street sewage disposal plant were also submitted with the revised plans and form a part of them. It appears from the plans and specifications that liquid chlorine is to be used to treat the effluent from the Imhoff tank. The chlorine apparatus, which, according to the specifications, is to be of an approved type, is to be installed in a small brick building 14′ 6″ x 9′ in plan.

The liquid chlorine is to be applied to the effluent near the bottom of the bend of a U-shaped 15-inch vitrified tile pipe into which the effluent from the settling tank empties. This 15-inch pipe is in turn to discharge into a small detention chamber having a capacity of about 1,500 gallons, so that the treated effluent will be retained in this chamber for an average period of about 35 minutes on the basis of design used. The effluent after treatment is to flow over a right angle weir to the outlet pipe leading to a small stream tributary to the Ramapo river. An automatic register operated by a float in the detention chamber set to automatically register the depth of flow on the outlet weir is to be provided. It would appear therefore that it will be possible to measure the flow of sewage and permit of regulating the application of liquid chlorine to the flow of the sewage.

Although no definite statement is made in the report of the designing engineer as to the exact amount of chlorine to be added to the effluent, it appears from the report that it is proposed to use from 6 to 8½ parts of liquid chlorine per million parts of sewage treated. I am of the opinion however that in order to effectively treat the sewage not less than 15 parts of chlorine per million should be used in treating the effluent from the settling tank. I am also of the opinion that, owing to the small size of the stream into which it is proposed to discharge the effluent, that the effluent pipe should be extended to the Ramapo river in order to better prevent the possibility of creating a nuisance.

As noted in my former report on the examination of the plans, the village authorities asked for approval to build at this time only the following sewers:

1,755 ft. in Chestnut street.
1,970 ft. in Orange avenue.
750 ft to Wayne avenue.
600 ft. of sewers in Lafayette avenue.

Application is also made for permission to build the Chestnut Street Imhoff tanks and to be allowed to substitute disinfection with chlorine gas for the sand filter. I would recommend that the application to temporarily omit all portions of the permanent general system of sewers and sewage disposal works, except as noted above, be granted under and in accordance with section 260 of the Village Law.

In conclusion I would state that in my opinion the proposed sewer system and sewage disposal works if properly constructed and if operated with care and efficiency should satisfactorily care for the sanitary sewage of the village, and I believe that a properly sterilized effluent from the Imhoff tank of the Chestnut Street plant may be safely discharged without objection into the Ramapo river at this time. The importance however of constructing sewers along Lake Antrim at the earliest practicable time cannot be too strongly emphasized inasmuch as the existence of privies and cesspools in close proximity to the shore of the lake is a constant menace to the village water supply, even though the water is filtered and treated with hypochlorite.

I would therefore recommend that the plans be approved and a permit be

issued allowing the discharged into the Ramapo river of effluent from the proposed sewage disposal plant on the following conditions:

1. That the effluent pipe from the chlorination plant be extended to the Ramapo river.
2. That not less than 15 parts of chlorine per million parts of sewage treated be applied to the effluent from the settling tank of the Chestnut Street plant before its discharge into the Ramapo river.
3. That whenever required by the State Commissioner of Health sand filters shown by the plans shall be constructed and put in operation.

Respectfully submitted,

THEODORE HORTON,
Chief Engineer

ALBANY, N. Y., *January* 11, 1915

PERMIT

Application having been duly made to the State Commissioner of Health, as provided by section 77 of chapter 49 of the Laws of 1909, the "Public Health Law," as amended by chapter 553 of the Laws of 1911, constituting chapter 45 of the Consolidated Laws, permission is hereby given to the board of trustees of the village of Suffern to discharge effluent from the proposed sewage disposal plants to be constructed in connection with the proposed sewer system for the village of Suffern into the waters of Ramapo river near the proposed site of the plant within the municipality of Suffern in accordance with plans accompanying the petition, under the following conditions:

1. That this permit shall be revocable at any time or subject to modification or change when in the judgment of the State Commissioner of Health such revocation, modification or change shall become necessary.
2. That the issuance of this permit shall not be deemed to affect in any way action by this Department on any future application that may be made for permission to discharge additional sewage or effluent into the waters of this State.
3. That both the sewer system and the sewage disposal works shown by plans approved this day shall be fully constructed in complete conformity with such plans or approved amendments thereof.
4. That only sanitary or domestic sewage and no storm water or surface water from streets, roofs or other areas shall be admitted to the proposed sewers.
5. That no sewage sludge from any part of the disposal works shall be discharged into the Ramapo river or any other watercourse.
6. That the effluent pipe from the chlorination plant shall be extended into the Ramapo river at least one-quarter the width of the stream and in such a manner as to be submerged at low water stage.
7. That not less than 15 parts of chlorine per million parts of sewage treated shall be applied to the effluent from the settling tank of the Chestnut Street plant before its discharge into the Ramapo river.
8. That whenever required by the State Commissioner of Health the sand filters shown by the plans shall be constructed and put in operation.

LINSLY R. WILLIAMS,
Deputy State Commissioner of Health.

BOARD OF TRUSTEES,
Suffern, N. Y.

GENTLEMEN.— In response to the application made to the State Commissioner of Health by your board under date of February 8, 1915, asking for the approval of said Commissioner to the temporary omission from construction of certain portions of the permanent general system of sewers and sewage disposal for the village of Suffern, plans for which were approved by this Department on January 13, 1915, I hereby certify my determination to approve and do approve of the temporary omission from construction of said portions, to wit: all those portions of the permanent general system of sewers and sewage disposal for the village of Suffern except the Chestnut Street sewage

disposal plant and the following sewers, viz.: commencing at a point opposite the Shuart livery stable on Orange avenue, running thence southerly on Orange avenue to Chestnut street; another branch commencing at a point in Wayne avenue opposite the fire house and running thence southerly to the intersection of Orange avenue; another branch commencing at a point in Lafayette avenue opposite the property of Sinell and running thence westerly to the intersection of Orange avenue; another branch commencing on Lafayette avenue opposite the property of Sinell and running thence easterly to the intersection of Chestnut street; another branch commencing at the corner of Lafayette avenue and Chestnut street and running from this westerly through Chestnut street and terminating in the Chestnut Street plant on the village property west of the underground crossing of the Erie railroad until in the judgment of the State Commissioner of Health or of the board of trustees of the village of Suffern the construction of such permanent portions may become necessary, on condition that whenever required by this department the sand filter shown by the plans shall be constructed and on condition that no portion of the sewer system tributary to the Ridge Avenue sewage disposal plant shall be constructed or put in use until the Ridge Avenue sewage disposal plant shall be constructed and ready for operation.

The above approval is given this 15th day of February, 1915, in accordance with Article IX, section 260 of chapter 64 of the Consolidated Laws, the Village Law.

LINSLY R. WILLIAMS,
ALBANY, N. Y. *Deputy State Commissioner of Health*

SUFFOLK COUNTY TUBERCULOSIS HOSPITAL

HERMANN M. BIGGS, M.D., *State Commissioner of Health:*

Plans for sewage disposal for the Suffolk County Tuberculosis Hospital at Farmingville, N. Y., were submitted for approval by the architect, Mr. Nathan Myers, on July 22, 1915.

The plans submitted for approval consist of duplicate blueprints showing:

1. Details of the disposal plant.
2. The general plan of the buildings and the grounds and also a United States Geological Survey quadrangle sheet showing the location of the tuberculosis hospital.

The general plan shows that it is proposed to collect the sewage from the hospital in two sewers which unite in front of the building and convey the sewage to the settling tank. The settling tank is to be a covered tank of the horizontal flow type constructed of concrete and brick and is to be provided with a manhole in the roof of the tank to give access for cleaning. The tank is to be circular in plan and is to have a submerged inlet and outlet.

The plan submitted does not give the dimensions of the structures. It appears however that the total population which will ultimately contribute sewage to the disposal plant will be about seventy-five people. If it is assumed that there will be a per capita rate of water consumption of about 100 gallons per day the total sewage flow may be estimated at about 7,500 gallons. The settling tank should have a period of detention of at least six hours or a capacity of about 2,000 gallons.

From the settling tank the sewage is to flow into a siphon chamber which consists of two compartments divided by a brick wall. The siphon will discharge the sewage into a diverting chamber which allows the tank effluent to be discharged into either half of a subsurface irrigation field. The size of the siphon chamber or the amount of subsurface tile pipe to be used is not shown on the plans. For a system of this kind receiving sewage from a hospital the system should be designed on a basis of about 25 to 30 feet of subsurface tile pipe per person contributing sewage to the system. The plans show that it is intended to lay the tile pipes with ¼-inch open joints and either to cover the joints with tar paper or with tile caps.

The general plan shows that it is intended to locate the absorption field in an area in front of a building and it appears that the soil is sand and gravel to the depth of about 120 feet. In view of these facts the subsurface irrigation system should operate successfully if properly constructed. There are apparently no nearby wells or other sources of water supply which will be polluted by the sewage from the disposal plant.

In view of our examination of the plans, and after careful consideration of the general and local requirements for the disposal of sewage from the Suffolk County Tuberculosis Hospital, I beg to recommend that the plans be approved on the following conditions:

1. That the settling tank be so constructed as to have a capacity sufficient to give a period of detention of the sewage in the tank of at least six hours.

2. That the subsurface irrigation field be so constructed that there will be at least twenty-five feet of subsurface tile pipe per person contributing sewage to the plant.

Respectfully submitted,
THEODORE HORTON,
Chief Engineer

ALBANY, N. Y., *August* 23, 1915

The plans were approved on the above conditions on August 27, 1915.

Plans revised to conform with the above recommendations were submitted for approval on October 8, 1915. The report on the amended plans follows:

HERMANN M. BIGGS, M.D., *State Commissioner of Health:*

Amended plans for sewage disposal at Suffolk County Tuberculosis Hospital were submitted for approval on October 8 by Mr. Oscar L. Rimoldi, contracting engineer, of 30 East 42d street, New York city.

The hospital is located about four miles north of Patchogue. The plans show that it is proposed to treat the sewage from the hospital, which has a capacity of seventy-five patients, by passing it through a settling tank and discharging it through a dosing chamber and diverting gate into two sections of subsurface irrigation tiling.

The settling tank, which is to be constructed of concrete or brick, is 4′ x 14′ in plan, inside dimensions, and has a capacity below the flow line of about 2,000 gallons, which will give a detention of between 8 and 9 hours for the sewage based on a contribution of 100 gallons per capita daily. The tank is provided with baffles but, although it has a single compartment, no provision is made for drawing off the sludge by a sludge pipe.

The effluent from the tank passes through a siphon or dosing chamber having a capacity of discharge of about 90 gallons, and from the siphon chamber the effluent is to pass through a two-way diverting gate into two fields of subsurface irrigation tiling. The subsurface tile fields consist of 5 lines each of 3-inch tiling 200 feet long laid 5 feet apart. The soil is sandy and the tiles are shown laid in a trench 15 inches wide and 18 inches deep with a tar paper cap over the joints and with the piping surrounded by sand and gravel. The amount of tiling provides for about 30 lineal feet per person to be served.

From our examination of the plans it is evident that the design is adequate to provide a plant which will satisfactorily treat the sewage from the hospital, although it is suggested that if possible a sludge pipe be constructed to discharge into trenches by gravity flow to obviate the necessity of pumping sludge from the plant after sludge has accumulated in the bottom of the tank. It is assumed of course, and the approval of the plans should be given only on the assumption, that no sources of potable water would be adversely affected by the location of the disposal plant at the point proposed.

In view of the above, I would recommend that the plans be approved.

Respectfully submitted,
THEODORE HORTON,
Chief Engineer

ALBANY, N. Y., *October* 21, 1915

The plans were approved on October 22, 1915.

SYRACUSE

HERMANN M. BIGGS, M.D., *State Commissioner of Health:*

Plans for a proposed sanitary sewer system known as Huntley System No. 2 in the Teall Avenue Sewer District in the city of Syracuse, Onondaga county, were submitted to this Department for approval by the city engineer on February 1, 1915.

The records of the Department show that plans for a proposed storm water overflow sewer designated to act as a relief sewer for the existing and proposed combined sewer systems in the Teall avenue sewer district in the northeasterly section of the city, were submitted to this Department for approval by the Syracuse intercepting sewer board on March 30, 1912. The overflow sewer was planned to discharge into Headson creek, a small stream tributary to Ley creek. Although these plans showed both the existing and projected combined system of sewers in the Teall avenue sewer district approval was asked for the proposition to construct the proposed storm water overflow only. In the report on the examination of these plans dated May 2, 1912, the objections to adding to the pollution of Headson and Ley creeks which already receive considerable pollution and which had been the subject of complaints to this Department by the health bureau of Syracuse, and the necessity for ultimate separation of sanitary sewage from the storm water in this district were pointed out. There were also certain features in connection with the submission of these plans which were not satisfactory from a legal standpoint and the plans were accordingly returned without the approval of the Department to the city authorities on May 27, 1912. They were advised at that time, however, that the approval of the plans would be considered providing the changes recommended in the report on the examination of the plans were properly made.

Plans for a combined sewer system in the so-called Huntley tract and for an overflow sewer from the Teall avenue sewer district discharging into Headson creek were submitted for approval by the city engineer on December 31, 1914. It was found from our examination of these plans which did not differ materially from the plans previously submitted, that they had not been prepared in accordance with the recommendations of this Department embodied in our report on the examination of plans dated May 2, 1912, and it was again pointed out that the construction of the combined sewers provided for by the proposed plans would be a step in the wrong direction and not in the best interests of either ultimate economy or public health of the residents of Syracuse and riparian owners along the creek and that it would be more advisable to arrange at once for a complete separation of the sewage from the storm water in the undeveloped portions and for the ultimate separation of the sewage and storm water in the developed sections of the district.

The plans now submitted comprise duplicate blue prints of the following:

1. A topographic map of the city drawn to a scale of 1 inch to 600 feet.
2. A plan showing the existing sewers of the city with the size and kind of sewer, the rate of grade and the direction of flow indicated thereon. Approximate scale 1 inch to 600 feet.
3. A map of Teall avenue district showing the existing proposed sewers and outlet to Headson brook, with the various area outlined in colors; this map also shows the changes proposed to be made in the existing combined sewers in areas A. B., C and F, scale 1 inch to 200 feet.
4. A map of the area "D" showing the lines of the proposed separate systems and their outlets. Scale 1 inch to 400 feet.
5. A set of blue prints showing plans and profiles of the proposed Huntley System No. 2. Scales, 50 feet horizontal 5 feet vertical to an inch.

A set of specifications for the construction of said sewers were also submitted.

It appears from the plans and data submitted by the city engineer that the greater portion of the city of Syracuse drains into Onondaga creek and Harbor brook and that two relatively small areas are on the watersheds

of Orville brook and Ley creek. The sewer system of the city has been constructed largely on the combined plan in accordance with plans prepared in 1895 by Mr. Samuel M. Gray, civil engineer and sanitary expert. The sewer system for the Teall avenue sewer district in the northeastern part of the city which district naturally drains toward Headson and Ley creeks was however designed on a modified separate plan providing for the admission of a limited amount of storm water to a tunnel sewer by means of which the sewage and some storm water was to be conveyed southwesterly across the city to the main portion of the sewer system tributary to Onondaga creek inasmuch as it was considered by Mr. Gray who planned the sewers that the dilution provided by Headson and Ley creeks was not sufficient to prevent the creation of a nuisance if the sewers discharged into these streams without purification.

The Teall avenue sewer district having an area of about 630 acres has for convenience been divided into six subdistricts, namely, A, B, C, D, E and F, having areas of 96, 155, 95, 210, 16 and 56 acres respectively.

Areas A, B and F, equal to about one-half of the sewer district, are developed and are provided with combined sewers varying in size from 12 to 50 inches in diameter, which sewers are tributary to the 33-inch tunnel sewer referred to above. Section C is sparsely populated and has only a few combined sewers which discharge into the tunnel sewer. Sections D and E which are also sparsely populated have no sewers at present.

The plans now under consideration provide for a system of sanitary sewers in sub-area D tributary to the tunnel sewer and for a storm water sewer system in this section planned to discharge into Headson brook through a proposed storm water sewer extending northerly in Teall avenue. The storm water sewers and the sanitary sewers are to be laid in the same trench. Consideration will be given only to the sanitary sewers inasmuch as the Public Health Law does not require the approval of this Department of plans designed exclusively for conveying storm water. A note on the plans states that "in subareas A and B the existing sewers, 24-inch and larger will be converted into storm sewers and new sanitary sewers built; other sewers will be converted into sanitary sewers and new storm sewers built." A note on the plans referring to section "C" states that "in this subarea the existing sewers will be used for sanitary purposes and new storm sewers built when needed." In connection with Section "F" it is stated that "in subarea 'F' the existing sewers will be used for sanitary purposes and new storm sewers built when needed." The proposed changes are shown in general by the plans and the report of the city engineer states that the changes will be made before connection is established with the proposed storm water outlet sewer to Headson creek so that no storm water carrying sewage will be discharged therein. It appears, therefore, that these plans have been prepared in general accordance with the recommendations of this Department.

The plans for the proposed sewer system in district D for which approval is asked are shown in detail. These sewers which cover practically the entire area vary in size from 8 to 22 inches in diameter and are to be constructed with slopes sufficiently steep to provide self-cleansing velocities under ordinary conditions. Manholes are to be installed at all points of change of slope and alignment and at intermediate points not more than 300 or 400 feet apart.

From our careful examination of the plans it is found that the plans have been revised to meet the requirements of this Department and that the proposed sewers if properly constructed should be adequate as to size and capacity to satisfactorily care for the sanitary sewage of the section to be served by them.

I would therefore recommend that the plans be approved and a permit be issued allowing the discharge into Onondaga creek of sewage to be collected by the proposed sewer and that the permit contain in addition to the usual revocation and modification clauses the condition that before the separation of the sanitary sewage from the storm water in sections A and B be effected, the sanitary sewers to be constructed in these sections and now shown in general by the plans be submitted to this Department for approval.

Respectfully submitted,

THEODORE HORTON,

ALBANY, N. Y., *February* 19, 1915 *Chief Engineer*

PERMIT

Application having been duly made to the State Commissioner of Health, as provided by section 77 of chapter 49 of the Laws of 1909, the "Public Health Law," as amended by chapter 553 of the Laws of 1911, constituting chapter 45 of the Consolidated Laws, permission is hereby given to the Common Council of the city of Syracuse to discharge sewage from the proposed Huntley Sewer System No. 2 in the Teall avenue sewer district into the waters of Onondaga creek through existing outfall sewers within the municipality of Syracuse in accordance with the plans accompanying the petition, under the following conditions:

1. That this permit shall be revocable at any time or subject to modification or change when in the judgment of the State Commissioner of Health such revocation, modification or change shall become necessary.
2. That the issuance of this permit shall not be deemed to affect in any way action by this Department on any future application that may be made for permission to discharge additional sewage or effluent into the waters of this State.
3. That only sanitary or domestic sewage, and no storm water or surface water from streets or other areas shall be admitted to the proposed sewers.
4. That before any sewers are constructed in Sections A and B to provide for the separation of the sanitary sewage from the storm water in these sections, detailed plans for the sanitary sewers to be constructed in these sections, now shown in general by the plans, shall be submitted to this Department for approval.

LINSLY R. WILLIAMS,
Deputy State Commissioner of Health

February 24, 1916

HERMANN M. BIGGS, M.D., *State Commissioner of Health:*

Amended plans for a proposed sanitary sewer system in the southeastern section of the city of Syracuse, designated as the 17th ward district, were submitted to this Department for approval by the City Engineer on behalf of the common council, April 13, 1915.

These plans, providing for a sanitary sewer system in this section of the city, including some 457 acres of land lying in the town of De Witt just east of the city line, which latter area it was alleged would probably soon be annexed to the city, were first submitted for approval on March 4, 1915. The plans as submitted, however, were very indefinite and too general to permit of a final examination of them and they were therefore returned to the city engineer who called at the Department on March 31, 1915, for the purpose of reviewing the plans.

According to the plans and report of the city engineer submitted to them, the southeastern part of the city south of the Erie canal is divided into two draining areas designated as "Y" and "X" on the plans. Area "Y" is drained by Orville brook, which flows easterly to Butternut creek, and area "X" drains westerly toward the Erie canal and Onondaga creek.

It appears from the city engineer's report that Mr. Samuel M. Gray, who prepared plans for a general sewer system for the city in 1895, planned for the construction of a combined sewer system in area "Y" and for the interception of twice the dry weather flow of sewage from this area at the foot of Dakota street, from which point it was planned to convey the intercepted sewage to the system of area "X" through a deep sewer extending through the divide between the two areas. It is stated also that there has been very little development in this section of the city since that time and that only a few sewers have been constructed in the southwestern portion of area "X".

It is now proposed to provide for a sanitary sewer system in sections "Y" and "X" and to convey the sanitary sewage from section "Y" into section "X" as originally planned. The sewage from both areas is to be discharged into the existing combined sewer in Washington street near Maple street,

which sewer forms a part of the main sewer system of the city tributary to Onondaga creek.

The proposed sewers vary in size from 8 to 27 inches in diameter and for the most part are to be constructed with fairly steep slopes considering the sizes of the sewers. The sewers are to have straight alignments between manholes and manholes are to be installed at all points of change of slope and alignment and at intermediate points on straight alignments at intervals of not more than 500 feet.

The main trunk sewer of these districts, which is to be from 8 inches to 27 inches in diameter, is to extend from the intersection of Broad street and Lancaster avenue to the Washington street sewer near Maple street, a distance of about three miles. About one mile of the sewer between Dakota and Genesee streets is to extend outside of the city limits through the western portion of the town of De Witt. The lower section of the trunk sewer will have a capacity when flowing full of about 10,000,000 gallons per day and should be adequate to care for the probable future population of the sections to be served by it.

There is a discrepancy between the profile and the plans with reference to the grades and slopes of the lower section of the sewer. It is assumed however that the figures shown by the general plan of the sewer are correct inasmuch as the slopes appear to check up with the grades given.

In conclusion I would state that it was found from our examination of the plans that the proposed sewers if properly constructed should satisfactorily care for the sanitary sewage of the sections to be served by them. I would therefore recommend that the plans be approved and a permit issued allowing the discharge into Onondaga creek of sewage from the proposed sewers.

Respectfully submitted,

THEODORE HORTON,

Chief Engineer

ALBANY, N. Y., *April* 14, 1915

PERMIT

Application having been duly made to the State Commissioner of Health, as provided by section 77 of chapter 49 of the Laws of 1909, the "Public Health Law," as amended by chapter 553 of the Laws of 1911, constituting chapter 45 of the Consolidated Laws, permission is hereby given to the common council of the city of Syracuse to discharge sewage from the proposed sewer system in the 17th ward district into the waters of Onondaga creek through existing outfall sewers within the municipality of Syracuse in accordance with the plans accompanying the petition, under the following conditions:

1. That this permit shall be revocable at any time or subject to modification or change when in the judgment of the State Commissioner of Health such revocation, modification or change shall become necessary.
2. That the issuance of this permit shall not be deemed to affect in any way action by this Department on any future application that may be made for permission to discharge additional sewage or effluent into the waters of this State.
3. That only sanitary or domestic sewage and no storm water or surface water from streets or other areas shall be admitted to the proposed sewers.

LINSLY R. WILLIAMS,

Deputy Commissioner of Health

April 15, 1915

TRIBES HILL (School house)

HERMANN M. BIGGS, M.D., *State Commissioner of Health:*

Plans for sewage disposal works for a new schoolhouse at Tribes Hill, an unincorporated village located on the boundary line between the towns of Mohawk and Amsterdam, in Montgomery county, were submitted for your

approval by the designing architect, Edward G. Atkinson of Schenectady, on July 28, 1915. The plans comprise duplicate blueprints showing a general plan of the proposed disposal works and details of several of the separate structures.

According to the report of the designer, the school building has a maximum capacity of 160, although the present number of pupils to attend the school will be about 80. He also stated in a conference with a member of the Engineering Division that the soil of the region is sandy and gravelly and because of its porous nature is well adapted to the employment of a system of subsurface irrigation.

The water supply for the school is to be derived from a dug well located about 130 feet from the disposal plant, and the designer stated that the slope of the ground surface is downward from the well and school building toward the disposal plant.

It is proposed to treat the sewage from the school building in a disposal plant to consist of a settling tank, siphon chamber, sludge well and subsurface irrigation field. The sewer leading from the schoolhouse to the disposal plant is to consist of about sixty feet of 5-inch vitrified tile pipe laid on a slope of 1 inch in 10 feet or about 0.8 per cent. The proposed settling tank, which is to be a single compartment tank, is to be constructed throughout of reinforced concrete and will be covered by a concrete roof in which two manholes provided with covers are to be placed. The inlet pipe is bent downward toward the bottom of the tank and carried about a foot below the flow line and a scum board to consist of a 2-inch plank is to be located near the outlet weir. As the sewage leaves the tank it is planned to have it pass through a wire screen, the location of slots for which are indicated. A screen, located as shown on the plans, will soon clog up and serve merely to back up the sewage in the tank, and it would appear better therefore not to place a screen at this point.

The settling tank is to be 10′ x 6′ in plan with a depth of 5′ 6″ below the flow line, which provides a capacity of about 2,475 gallons. From available data of the consumption of water at schools of this kind it would appear safe to assume that it will not exceed ten gallons per capita per day. For the present attendance of eighty, and the above rate of water consumption, the settling tank will have a capacity to give a period of detention of the sewage in the tank of about three days and for the future attendance of 160 pupils the period of detention of the sewage in the tank will be about 1.5 days.

A sludge well 2′ x 2′ in plan is to be built as a contiguous part of the settling tank and a sludge pipe controlled by a 6-inch valve permits the discharge of the sludge into the sludge well, from which it is apparently the intention to dip it out. A sludge bed for the draining and drying of the sludge has not been shown by the plans, but the sludge will probably not have to be removed more frequently than once each year and can be done in the late summer, when it will have had several months to digest, and can be disposed of in some locality where no objectionable conditions will be created.

The effluent from the settling tank is to flow over a weir into an adjacent dosing chamber provided with a 5-inch automatic siphon, by means of which the settled sewage is to be discharged into a proposed subsurface irrigation system. The automatic siphon is not shown on the plans, but it is stated that it will be constructed according to detailed instructions furnished by the Pacific Flush Tank Company. The capacity of the siphon chamber below the discharge level of a 5-inch siphon is about 280 gallons, which for a sewage flow of 800 gallons daily will cause the siphon to discharge about three times per day and for a daily sewage flow of 1,600 gallons will discharge about six times a day.

The sewage will flow through a 6-inch pipe line to a diverting chamber, from which it may be discharged into two 6-inch vitrified tile pipe lines from which branch 500 linear feet of 4-inch drain tile laid with open joints in lines three feet apart on a grade of 1 per cent. The joints are to be protected on the top by tar paper and the pipe will be laid in trenches on about six inches of crushed stone which will be placed around it and over it to a depth of about one foot and covered with six inches of earth, giving a total depth of eighteen inches.

The absorption area of the subsurface irrigation system has an area of approximately .038 acre, which for a sewage flow of 800 gallons per day gives a rate of application of about 21,000 gallons per acre per day and for a sewage flow of 1,600 gallons per day gives a rate of 42,000 gallons per acre per day. This subsurface irrigation system provides about 6.25 feet of tiling per person for the present population and slightly over three feet per person for the ultimate population of 160. In subsurface irrigation fields treating domestic sewage it is usual to provide from 25 to 50 feet of tiling per person when the field is to be constructed in porous soil. Owing, however to the lower per capita rate of water consumption, the absence of a large percentage of grease, and the smaller organic content of the sewage from schoolhouses, it is not necessary to provide so many feet of tiling per person for schoolhouse sewage as would be necessary for ordinary domestic sewage. Unless the soil is very porous, it is probable that it will be necessary to extend this system in the near future. If possible the system should be constructed at a sufficient distance from the boundary line of the school property so that sufficient area will be available to allow the subsurface irrigation system to be extended when such extension becomes necessary.

In view of the fact that the school children will be in the school yard for considerable periods each day, the sewage disposal plant and subsurface irrigation field should be fenced off from the rest of the school yard in order that the children by digging in the soil or in the course of games will not disturb the proper operation of the plant.

From our careful examination of the plans it appears that the proposed sewage disposal plant, if properly constructed and maintained with care and efficiency, should satisfactorily care for the sewage from the schoolhouse. I would therefore recommend that the plans be approved on condition that the plant be located at a sufficient distance from the boundary line of the school property to allow for extension of the subsurface irrigation system when necessary, and that the disposal plant including the subsurface irrigation field be fenced off from the rest of the school yard.

Respectfully submitted,

THEODORE HORTON,
Chief Engineer

Albany, N. Y., *July* 30, 1915

The plans were approved on August 11, 1915.

TUCKAHOE

See Bronxville, page 56.

UNADILLA

In the Matter of the Application of the Village of Unadilla for an Extension of the time for Submitting Plans for a Comprehensive Sewer System for the Village and for Sewage Disposal Works to treat the Sewage of the Village as required by the State Department of Health.

Whereas, the village of Unadilla through President C. C. Moore, and by letter from Mr. Chas. C. Flaesch, attorney, dated February 19, 1915, written at the request of President Moore, has applied to this Department for an extension of the time for submitting to this Department for approval satisfactory detailed plans for a comprehensive sanitary sewer system for the village and for the sedimentation of the entire sanitary sewage of the village, together with general plans for more complete treatment of the sewage, which plans were required to be submitted to this Department on or before October 1, 1915, under the terms of the permit for sewage discharge granted to the Board of Trustees of the village of Unadilla by this Department on July 28, 1914, and it appearing that considerable expenditure of

funds has been incurred by the village for various purposes and it appearing that the village authorities have given proper assurance that the requirements of this Department in the matter of submitting plans will be met within a time specified if the extension of time for filing plans is granted and;

WHEREAS, such application and the reasons therefor for such extension of the time for filing such plans have been carefully considered by me and deemed to be a reasonable request;

NOW THEREFORE, I, Linsly R. Williams, Deputy State Commissioner of Health, under the authority vested in me by the provisions of Section 76 and Section 77 of the Public Health Law as amended by Chapter 553 of the Laws of 1911, do hereby on this 13th day of March, 1915, extend the time for submitting such plans for a comprehensive sanitary sewer system and for sewage disposal works from October 1, 1915, to May 1, 1916.

LINSLY R WILLIAMS,
ALBANY, N. Y. *Deputy State Commissioner of Health*

This extension of the time for submitting plans for a comprehensive sanitary sewer system and for sewage disposal works to treat the sewage of the village of Unadilla constituting an amendment to the permit for sewage discharge granted on July 28, 1914, to be operative must first be recorded in the county clerk's office of Otsego county.

WAPPINGERS FALLS

HERMANN M. BIGGS, M.D., *State Commissioner of Health:*

Amended plans for sewage disposal for the village of Wappingers Falls, Dutchess county, were submitted to this Department for approval by the Board of Trustees on January 25, 1915.

The records of the Department show that plans for a sanitary sewer system and for a sewage disposal plant consisting of an Imhoff tank and auxiliary sludge bed for the disposal of sludge, were submitted for approval on March 12, 1914. It appears from the examination of these plans that although they were in general satisfactory, there were a number of additions and modifications which should be made in them before they would be in satisfactory condition for final acceptance and they were accordingly returned to the village authorities for revision on May 4, 1914. On July 17, and September 9, plans providing for the substitution of a fine screen of the Reinsch-Wurl type for the proposed Imhoff tank shown by the original plans were submitted. Neither of these sets of plans, however, were in satisfactory condition for approval and were returned for revision under dates of August 19 and September 25, 1914.

Finally on October 9, 1914, plans for a sewer system and for a sewage disposal plant consisting of a duplicate set of Reinsch-Wurl screens and general plans for supplementary or more complete treatment of the sewage of the village were submitted for approval. These plans which had been revised in accordance with the requirements of this Department were approved on October 20, 1914. Reference is made to my reports dated April 30, September 23, and October 13 on our examination of the different sets of plans for sewerage and sewage disposal presented by the village. These reports discuss in detail the essential features of the design of the different plans and review the action taken by the Department in reference to them.

The plans now submitted and under consideration provide for the substitution of the settling tank shown by the original plans for the proposed Reinsch-Wurl screens provided for by the plans approved on October 20. These plans for sewage disposal are substantially the same as originally presented except that certain details of the design of the settling tank not shown by the original plans have been added. It is stated by the report of the designing engineer that the reason for making the proposed change in the

type of works for preliminary treatment is that at least $2,500 can be saved, thereby in the cost of construction. The report also states that the effluent from the tank is to be conveyed to Wappingers creek and discharged below low water and that plans for supplementary treatment works for future use shown in general by the approved plans are not to be replaced at this time.

The proposed settling tank as described in detail in my report dated April 30, 1914, is to be a circular radial flow tank of the Imhoff type and is to be divided by means of reinforced concrete partitions into an upper settling compartment and a lower compartment for the storage and digestion of sludge. The settling compartment will give a time of detention of about four hours when serving the present population on the usual assumptions as to per capita rate of sewage contribution and should, therefore, be adequate as to capacity to provide for a reasonable increase in the population in the future. The flow line of the tank is to be at elevation 55 feet above mean tide, which is practically the same as the flow line of the effluent channel of the screening plant shown by the approved plans and should give ample head to provide for the operation by gravity flow of supplementary treatment works.

The sludge is to be removed from the tank through an 8-inch cast iron pipe and discharged by gravity flow to adjacent sludge drying bed. This bed which is to be 8½ feet by 40 feet in plan is to be filled to a depth of about 8 inches with graded broken stone or gravel over which is to be placed an 8-inch layer of coarse sand. The underdrain system is to consist of a central 8-inch collecting drain and parallel lines of 4-inch lateral drains spaced 4 feet, 9 inches center to center. The effluent from the sludge bed is to discharge directly into the creek.

In conclusion, I would state, that it appears from our examination of the plans that the proposed sewage disposal plant if properly constructed and operated should satisfactorily care for the sanitary sewage of the village of Wappingers Falls and produce an effluent which might safely be discharged into Wappingers creek at this time without objection.

I would, therefore, recommend that the plans be approved and a permit be issued allowing the discharge into Wappingers creek within the municipality of Wappingers Falls of effluent from the proposed sewage disposal plant on condition that whenever required by the State Commissioner of Health, satisfactory detailed plans for additional works for more complete treatment of the sewage of the village shall be submitted for approval; and thereafter upon approval of said plans any or all portions of such additional works for more complete treatment of sewage shall be constructed and put in operation at such time or times as said commissioner may designate.

Respectfully submitted,

THEODORE HORTON,
Chief Engineer

ALBANY, N. Y., *February* 18, 1915

PERMIT

Application having been duly made to the State Commissioner of Health, as provided by section 77 of chapter 49 of the Laws of 1909, the "Public Health Law," as amended by chapter 553 of the Laws of 1911, constituting chapter 45 of the Consolidated Laws, permission is hereby given to the board of trustees of the village of Wappingers Falls to discharge effluent from the sewage disposal works to be constructed in connection with the proposed sewer system for the village into the waters of Wappingers creek at the point of discharge shown by the plans within the municipality of Wappingers Falls in accordance with the plans accompanying the petition, under the following conditions:

1. That this permit shall be revocable at any time or subject to modification or change when in the judgment of the State Commissioner of Health such revocation, modification or change shall become necessary.
2. That the issuance of this permit shall not be deemed to affect in

any way action by this Department on any future application that may be made for permission to discharge additional sewage or effluent into the waters of this State.

3. That both the sewer system and the sewage disposal works shown by plans approved this day shall be fully constructed in complete conformity with such plans or approved amendments thereof.

4. That only sanitary or domestic sewage and no storm water or surface water from streets, roofs or other areas shall be admitted to the proposed sewers or sewage disposal works.

5. That no sewage sludge from any part of the disposal works shall be discharged into Wappingers creek or any other watercourse.

6. That whenever required by the State Commissioner of Health, satisfactory detailed plans for additional works for more complete treatment of the sewage of the village shall be submitted for approval; and thereafter upon approval of said plans any or all portions of such additional works for more complete treatment of sewage shall be constructed and put in operation at such time or times as said Commissioner may designate.

LINSLY R. WILLIAMS,
Deputy Commissioner of Health

WATERTOWN

Hermann M. Biggs, M.D., *State Commissioner of Health:*

Plans for a proposed sewer extension in the city of Watertown, Jefferson county, were submitted to this Department for approval by the board of public works on September 1, 1915.

The plans provide for a sanitary sewer in Mohawk street between Erie and Superior streets, a distance of about 400 feet. This sewer is to be tributary to the existing sewer in Superior street which empties into the Black river through the North Side Trunk sewer outlet. The proposed sewer is to be 8 inches in diameter and is to be constructed with a slope of .5 per cent. A manhole is to be installed on the upper end of the sewer and another at its intersection with the existing sewer at Superior street.

From our examination of plans it is found that the proposed sewer if properly constructed should satisfactorily care for the sanitary sewage from the section to be served by it, and I therefore recommend that the plans be approved and a permit be issued allowing the discharge into the Black river of sewage to be collected by the proposed sewer.

Respectfully submitted,
THEODORE HORTON,
Chief Engineer

Albany, N. Y., *September* 21, 1915

Permit

Application having been duly made to the State Commissioner of Health, as provided by section 77 of chapter 49 of the Laws of 1909, the "Public Health Law," as amended by chapter 553 of the Laws of 1911, constituting chapter 45 of the Consolidated Laws, permission is hereby given to the board of public works of the city of Watertown, to discharge sewage from the proposed sewer in Mohawk street into the waters of the Black river through the North Side Trunk sewer outlet within the municipality of Watertown in accordance with the plans accompanying the petition, under the following conditions:

1. That this permit shall be revocable at any time or subject to modification or change when in the judgment of the State Commissioner of Health such revocation, modification or change shall become necessary.

2. That the issuance of this permit shall not be deemed to affect in any way action by this Department on any future application that may be made for permission to discharge additional sewage or effluent into the waters of this State.

LINSLY R. WILLIAMS,
Deputy State Commissioner of Health

September 24, 1915

WEBB (Property of L. W. Brown)

HERMANN M. BIGGS, M.D., *State Commissioner of Health:*

Plans for sewage disposal for the property of Mr. L. W. Brown on Big Moose lake in the town of Webb, Herkimer county, were submitted to this Department for approval on March 30, 1915.

The property in question is located near North Bay on the northwesterly shore of Big Moose lake. This lake empties into the North Branch Moose river, a tributary of the Black river. No public water supply is taken from this stream and the nearest water supply taken from the Black river is at Watertown some 85 miles below the lake where gravity mechanical filters and sterilization are employed.

According to the report of the designing engineers, the camp to be served by the proposed sewage disposal plant will have a population varying from 6 to 12 persons. The proposed sewage disposal plant is to consist of a settling tank which is to be 6 feet by 3 feet by 4 feet deep, giving a capacity of 540 gallons. The tank will, therefore, provide a detention period of from 10 to 21 hours on the basis of design used assuming a per capita rate of sewage distribution of 100 gallons per day.

The settling tank is to be provided with a submerged inlet and outlet and baffles are to be placed both near the inlet and outlet. A sludge pipe provided with a gate valve is to be connected with the deepest portion of the tank. The plans, however, do not show where the sludge is to discharge nor is any statement submitted as to the proposed method of disposing of it. Sludge should not be discharged into the lake nor into any other body of water but should be discharged into trenches so as to permit of covering it.

It is stated by the designing engineer that the effluent of the tank is to be carried out into the lake through a 4-inch pipe so that the outlet will be covered at all times with a reasonable depth of water. Both the sewer leading to the tank and the sewer leading from the tank should be laid with straight slopes and alignments and at all points of change of slope or alignments manholes should be placed. The tank should also be so placed with reference to the lake as to permit of constructing and operating by gravity flow, if possible, supplementary works for more complete treatment of the sewage should such supplementary or more complete treatment be required in the future.

In view of the above, I would recommend that the plans be approved and a permit be issued allowing the discharge into Big Moose lake of effluent from the proposed sewage disposal plant. I would further recommend that the permit issued in connection with the approval of the plans contain in addition to the usual revocation and modification clauses the following conditions:

1. That the proposed settling tank be so placed as to permit of constructing and operating by gravity flow, if possible, works for more complete treatment of the sewage than provided for by the plans should such supplementary or more complete treatment be required in the future.
2. That no untreated sewage or sewage sludge be discharged into Big Moose lake or any other body of water.
3. That the sewer leading to the tank and the outlet pipe from the proposed tank shall be constructed with straight alignments and that manholes shall be placed at all points of change of slope or alignments.

Respectfully submitted,
THEODORE HORTON,
Chief Engineer

ALBANY, N. Y., *May* 3, 1915

PERMIT

Application having been duly made to the State Commissioner of Health, as provided by section 76 of chapter 49 of the Laws of 1909, the "Public Health Law," as amended by chapter 553 of the Laws of 1911, constituting chapter 45 of the Consolidated Laws, permission is hereby given to L. W. Brown, Esq., to discharge effluent from the proposed sewage disposal plant for the property of Mr. Brown into the waters of Big Moose lake at the point shown on the plans within the municipality of the town of Webb, in accordance with the plans accompanying the petition, under the following conditions:

1. That this permit shall be revocable at any time or subject to modification or change when in the judgment of the State Commissioner of Health such revocation, modification or change shall become necessary.
2. That the issuance of this permit shall not be deemed to affect in any way action by this Department on any future application that may be made for permission to discharge additional sewage or effluent into the waters of this State.
3. That both the sewers and the sewage disposal works shown by plans approved this day shall be fully constructed in complete conformity with such plans or approved amendments thereof.
4. That only sanitary or domestic sewage and no storm water or surface water from grounds, roofs or other areas shall be admitted to the proposed sewers.
5. That no sewage sludge from any part of the sewage disposal works shall be discharged into Big Moose lake or any other watercourse or body of water.
6. That the proposed settling tank shall be so placed to to permit the constructing and operating, by gravity flow if possible, works for more complete treatment of the sewage than that provided for by the plans should such supplementary or more complete treatment be required in the future.
7. That the sewer leading to the settling tank and the outlet pipe from the proposed tank shall be constructed with straight alignment and that manholes shall be placed at all points of change of slope and alignment.

LINSLY R. WILLIAMS,
May 3, 1915 *Deputy State Commissioner of Health*

WESTFIELD

HERMANN M. BIGGS, M.D., *State Commissioner of Health:*

Plans for the reconstruction and enlargement of the present sludge bed forming a portion of the sewage disposal works of the village of Westfield, Chautauqua county, were submitted to this Department for approval by the sewer commissioners of the village on March 30, 1915.

Plans for a sanitary sewer system and for sewage disposal works consisting of septic tanks, contact beds and a sludge drying bed for the disposal of sludge were approved on February 10, 1910. Certain unsatisfactory features of the design of the sludge bed with reference to its elevation and location provided for by these plans were pointed out in the report on the examination of them. The permit issued in connection with the approval of the plans accordingly contained the following conditions:

1. That both the sewer system and the sewage disposal plant shall be fully constructed in complete conformity with the plans approved this day except that the location and design of the sludge bed shall be changed as may be necessary to comply with the following condition.
2. That no untreated sewage or sewage sludge shall be discharged into Chautauqua creek and no direct outlet shall be constructed from the septic tank or from the sludge bed to the stream; and that if the sludge bed is underdrained at least one foot of sand shall be placed and maintained over the collecting tile at all points.

On October 3 and 4, 1914, an inspection of the sewage disposal plant of the village of Westfield was made by a representative of this Department in connection with the general investigation carried on of sewage disposal plants in the State. This inspection showed that the sludge bed had not been constructed in accordance with the above requirements, that the sludge bed was too small and that not only was the sewage being discharged directly into the stream but that sludge was allowed to flow into the creek through a pipe installed in the embankment placed around the bed. It was recommended, therefore, in the report of the inspection that the sludge bed should be reconstructed and enlarged, that it should be properly underdrained and that the existing sludge outlet to the creek should be sealed up and the by-pass for sewage removed.

The plans now presented and under consideration have been submitted in compliance with the above recommendations with reference to the sludge bed and provide for a sludge bed with concrete sides and bottom having an area of 2,800 square feet. It is to be located practically on the same site as the original bed adjacent to one of the contact beds and is to be provided with 18 inches of filtering material consisting of a lower layer of coarse cinders 12 inches deep supporting a top layer of sand 6 inches in depth. The bed is to be underdrained by means of the central drain consisting of 6-inch split tile invert covered by an 8-inch half tile pipe. A gate is shown near the outlet of the underdrain.

Although the elevation of the creek and of the different portions of the septic tanks is not shown, it would appear that the elevation of the surface of the sludge bed is from one-half to one foot above the bottom of the septic tanks and that the underdrain of the bed is about one foot above the level of the water at this point assuming that the datum used in the present design is the same as that of the plans approved in 1910. It would seem, therefore, that it is impracticable to construct a sludge bed at the proposed site sufficiently low to permit of draining the septic tanks by gravity flow and that it will be necessary either to select another site at a lower elevation or to pump the sludge inasmuch as it is essential to the successful operation of the tanks that all of the sludge should be removed from them at each cleaning.

If a lower site cannot be secured a pumping equipment should be installed in order to pump the sludge from the lower portions of the tanks which cannot be drained by gravity to the sludge beds. It is probable that a portable diaphragm pump driven either by hand or by a gasoline engine would satisfactorily answer the purpose.

With respect to the design of the proposed sludge bed, it does not seem necessary to construct a bed with a concrete floor unless the subsoil at the site is of a very unstable nature, nor does it appear necessary to provide concrete sides inasmuch as there is no particular advantage in having sludge beds watertight. If, however, there is any danger of the earthen embankment around the sludge bed being washed out by high water of the stream, it might be well to construct a concrete retaining wall on the stream side of the sludge bed. Otherwise this precaution should not be necessary.

If it is found necessary or desirable to retain the present site for sludge disposal, the bed should be located at least 10 feet from the contact bed or septic tanks in order that the foundation of these structures may not be disturbed by the excavation of the sludge bed. The sludge bed should also be provided with additional underdrains.

In conclusion I would state that it appears from our examination of plans that the proposed sludge bed if properly constructed should be adequate as to size to care for the sludge from the proposed septic tank and that the filtering material, if properly placed, should be suitable to provide proper drainage for the bed. The bed, however, is located too close to the contact beds and septic tanks and is at too high an elevation to permit of complete emptying the tanks without pumping.

I would, therefore, recommend that the plans be returned for revision in accordance with the recommendations contained in this report.

Respectfully submitted,
THEODORE HORTON,
Chief Engineer

ALBANY, N. Y., *April 26*, 1915

The plans were accordingly returned to the designing engineer for revision.

HERMANN M. BIGGS, M. D., *State Commissioner of Health:*

Revised plans for a proposed sludge bed to be constructed in connection with the sewage disposal plant at Westfield, Chautauqua county, were submitted to this Department for approval on June 1, 1915.

These plans were first submitted for approval at the recommendation of this Department on March 30, 1915, and after a careful examination of them a report was prepared setting forth the result of the examination and making recommendations for certain modification of the plans before the final acceptance of them. Although it was pointed out in this report that the proposed sludge bed appeared to be of adequate size to care for the sludge from the disposal plant, certain objections were raised to a number of features of the design, to its location with reference to the contact beds, and to its elevation with respect to the bottom of the septic tanks. The plans were accordingly returned to the designing engineer with the recommendation that the bed should be so located as to permit of draining the tanks by gravity flow if possible or that provision should be made for pumping the sludge and that it be located further from the contact beds.

The designing engineer subsequently reported that the location of the bed could not be changed owing to the limited area available and that since the bed was to be constructed in rock excavation it had been designed with a concrete floor to even up the bottom of the bed to provide proper drainage. It was also stated that the side walls of the bed had been designed especially heavy in order to add to the stability of the contact bed walls and that a pump would be provided to pump out the portion of the tank which cannot be drained by gravity. The engineer was, therefore, advised that under the existing conditions the approval of the plans would be considered provided that additional underdrains be shown and that a statement be submitted as to the kind, size and capacity of the pump to be used to pump the sludge.

The plans now submitted show that the sludge bed is to be provided with a central underdrain from which are to extend 10 lines of lateral drains consisting of 6-inch half tile. These drains are to be spaced 15 feet apart center to center. The report of the engineer also states that it is proposed to provide a Eureka pumper having a capacity of 3,500 gallons per hour. This pump is to be driven by a 1½ h. p. gasoline motor and should provide for a satisfactory means of removal of the sludge.

From our careful examination of the plans it appears that the proposed sludge bed if properly constructed in accordance with the plans and if properly maintained should satisfactorily care for the sludge from the settling tanks of the disposal plant at Westfield, and I would therefore recommend that the plans be approved.

Respectfully submitted,
THEODORE HORTON,
Chief Engineer

ALBANY, N. Y., *June* 2, 1915

The plans were approved on June 2, 1915.

WESTFIELD (Welch Grape Juice Co. and Armour & Co.)

HERMANN M. BIGGS, M.D., *State Commissioner of Health:*

Plans for a disposal plant to treat the wastes from the plant of the Welch Grape Juice Company and from the grape juice plant of Armour & Company at Westfield, Chautauqua county, were submitted for approval on August 19, 24 and 25, 1915, by the companies. Formal application for the approval of the plans has been received from both companies.

The records of this Department show that an investigation of the effect of the discharge of wastes from the Welch Grape Juice Company plant into Chautauqua creek was made in October, 1912, and of the effect of the discharge of wastes from the Armour & Company grape juice plant into a small

tributary to Lake Erie was made in May, 1914, by a representative of this Department, and in the reports upon these investigations the necessity of taking steps to properly dispose of the wastes from these plants was pointed out.

The plans submitted for approval consist of blue prints in duplicate from both companies showing:

1. General plan of grape juice plants and sewer.
2. Profile of proposed sewers.
3. Details of proposed screening plant for the Armour and Welch factories.

The plans submitted for approval show that it is proposed, after first passing the wastes through screens, to discharge the wastes from both grape juice factories into a proposed sewer to be laid a distance of about 9,850 feet along several streets to Lake Erie.

From the detailed plans of the screening plant to treat the wastes from the Armour & Company factory, it appears that the screens are to be cylindrical in shape, with 16 mesh screening around the sides and bottom but with open tops and are to stand in a tank to be provided with a false bottom. The screens will be four in number, 3 feet in diameter, with a total depth of 3 feet and an effective depth of about 1 foot below the flow line. The screens will rest upon the false bottom of the tank which are to be 8 feet by 11 feet in plan, with a total depth of about 2 feet, 9 inches. The false bottom is to consist of 2-inch by 4-inch timbers and laid 4 inches apart on supports which will raise the timbers 4 inches above the floor of the tank. It is to be expected that there will be a gradual accumulation of deposits around and under the false bottom and provision should therefore be made to allow this part of the tank to be flushed out. An outlet closed by a tight valve and connected with the main outlet pipe could be provided for this purpose in the bottom.

The inlet pipes are to be supported above the screens and will be in duplicate, each inlet to be provided with a 4-inch swinging spout which will allow the wastes to be discharged into either of two of the screens. Facilities have thus been provided to remove the screens for emptying and cleaning and a track with blocks and tackle is also to be provided for this purpose. The 6-inch outlet pipe, the invert of which will be about 1 foot 5 inches above the floor of the tank is also to be covered with a 16-mesh screen. Apparently no provision has been made to remove the outlet screen for cleaning, and it is to be expected that this screen will ultimately become clogged and will have to be removed and cleaned, therefore it would be better to arrange the screen so that this can be done easily.

The location of the screening plants are not shown on the plans. It is important that they should be placed as near the factories as possible, since the solids in the wastes become commutated in flowing through the sewers and a lower percentage of the solids will therefore be removed by the screens after a long period of flow.

The screening plant for the wastes from the Welch Grape Juice factory is to consist of four screens exactly similar to those to be employed at the Armour plant, but the screens are to be contained in a circular tank 9 feet in diameter, apparently to be constructed of sheet metal. The four screens are to rest upon a false bottom to consist of 2-inch by 4-inch timbers, as in the Armour plant. A 4-inch distributing pipe is to be placed around the periphery of the tank at the top and movable inlets, provided with shear valves, are to discharge the wastes into the screens.

A 6-inch outlet pipe, having a screen at its upper end which is placed at a point about 1 foot above the bottom of the screens, is to discharge the screened wastes through the bottom of the tank at the center. The screen over the outlet pipe should be made removable for cleaning and a means of flushing out the tank under the false bottom should also be provided, as described for the Armour plant.

The screened wastes from the two factories are to be discharged through 8-inch vitrified tile pipe sewers into a manhole a short distance south of the Lake Shore & Michigan Southern Railroad tracks, under which the sewage

is to pass through 100 feet of cast-iron pipe. Beyond the railroad tracks the sewer is to be continued as a 10-inch vitrified tile pipe sewer, to be laid on a slope of 0.6 per cent. The 10-inch sewer discharges into a 12-inch sewer to be laid on slopes of 0.4 per cent., which connects with a 10-inch sewer to be laid on slopes of 1 per cent. and 1.5 per cent. The 10-inch sewer is reduced to 8 inches when the grade reaches 2.20 per cent. and 2.40 per cent. A drop manhole is to be located at the point where the grade of the sewer is suddenly lowered at the bluffs of the Lake Erie shore, and the point of discharge is apparently to be located in the lake about 50 feet from these bluffs.

The grades of the sewer are to be sufficiently steep to provide self cleansing velocities of the wastes in the sewers and to prevent clogging, especially as the wastes will have been screened. Manholes are to be placed at every change of grade and alignment of the sewer, and although the maximum spacing between manholes is slightly over 700 feet the spacing averages about 600 feet; and in view of the adequate grades of the sewer, ample facilities for inspection and cleaning the sewer will have been provided. The outlet pipe should be secured in place to prevent its rupture by wave and ice action.

In view of the results of our examination of these plans and after careful consideration of local and general requirements for the disposal of wastes from the Welch Grape Juice Company factory and the Armour Grape Juice Company factory at Westfield, I beg to recommend that the plans be approved on the following conditions:

1. That no sanitary sewage and only wastes resulting from the pressing of grapes and bottling of grape juice shall be discharged into Lake Erie through the proposed sewer.
2. That when required by the State Commissioner of Health, additional works for the more complete treatment of the wastes shall be constructed.
3. That a duplicate of the blue print showing details of the Welch screening plant be submitted.

Respectfully submitted,

THEODORE HORTON,
Chief Engineer

Albany, N. Y., *August* 26, 1915

Permit

Application having been duly made to the State Commissioner of Health, as provided by section 78 of chapter 49 of the Laws of 1909, the "Public Health Law," as amended by chapter 553 of the Laws of 1911, constituting chapter 45 of the Consolidated Laws, permission is hereby given to the Welch Grape Juice Company to discharge effluent from the works to treat the wastes from the grape juice plant of said company at Westfield into the waters of Lake Erie through that outfall sewer shown by the plans within the town of Westfield in accordance with the plans accompanying the petition, under the following conditions:

1. That this permit shall be revocable at any time or subject to modification or change when in the judgment of the State Commissioner of Health such revocation, modification or change shall become necessary.
2. That the issuance of this permit shall not be deemed to affect in any way action by this Department on any future application that may be made for permission to discharge additional sewage or effluent into the waters of this State.
3. That both the outfall sewer and the disposal works shown by the plans approved this day shall be constructed in complete conformity with such plans or approved amendments thereof.
4. That no sanitary or domestic sewage and no storm water or surface water from streets, grounds, roofs or other areas shall be admitted to the proposed disposal works.
5. That no sewage sludge or screenings from any part of the disposal works shall be discharged into Chautauqua creek or into Lake Erie or into any other watercourse or body of water.

6. That whenever required by the State Commissioner of Health, satisfactory detailed plans for the extension of the outlet pipe or for additional works for more complete treatment of the wastes, or both, shall be submitted for approval; and upon approval of said plans such extension of the outlet pipe or any or all portions of such additional or supplementary works for more complete treatment of the wastes or both the extension of the outlet pipe and the said additional works shall be constructed and put in operation at such time or times thereafter as said commissioner may designate.

LINSLY R. WILLIAMS,
Deputy State Commissioner of Health

September 3, 1915

PERMIT

Application having been duly made to the State Commissioner of Health, as provided by section 78 of chapter 49 of the Laws of 1909, the "Public Health Law," as amended by chapter 553 of the Laws of 1911, constituting chapter 45 of the Consolidated Laws, permission is hereby given to Armour & Company to discharge effluent from the works to treat the wastes from the grape juice plant of said company at Westfield into the waters of Lake Erie through the outfall sewer shown by the plans within the town of Westfield, in accordance with the plans accompanying the petition, under the following conditions:

1. That this permit shall be revocable at any time or subject to modification or change when in the judgment of the State Commissioner of Health such revocation, modification or change shall become necessary.
2. That the issuance of this permit shall not be deemed to affect in any way action by this Department on any future application that may be made for permission to discharge additional sewage or effluent into the waters of this State.
3. That both the outfall sewer and the disposal works shown by the plans approved this day shall be constructed in complete conformity with such plans or approved amendments thereof.
4. That no sanitary or domestic sewage and no storm water or surface water from streets, grounds, roofs or other areas shall be admitted to the proposed disposal works.
5. That no sewage sludge or screenings from any part of the disposal works shall be discharged into Chautauqua creek or into Lake Erie or into any other watercourse or body of water.
6. That whenever required by the State Commissioner of Health, satisfactory detailed plans for the extension of the outlet pipe or for additional works for more complete treatment of the wastes, or both, shall be submitted for approval; and upon approval of said plans such extensions of the outlet pipe or any or all portions of such additional or supplementary works for more complete treatment of the wastes or both the extension of the outlet pipe and the said additional works shall be constructed and put in operation at such time or times thereafter as said commissioner may designate.

LINSLY R. WILLIAMS,
Deputy State Commissioner of Health

September 3, 1915

WHITE PLAINS (Gedney Farm)

HERMANN M. BIGGS, M.D., *State Commissioner of Health:*

Plans for the temporary disposal of sewage from a number of cottages on the Gedney farm property in the town of White Plains were submitted to this Department for approval on February 12, 1915.

The matter of the disposal of sewage from the Gedney farm property has been before the Department from time to time for a considerable period and

has been investigated on a number of occasions. On December 30, 1913, plans for a sewage disposal plant consisting of sedimentation tanks, sand filters, chlorination plant and contact trenches, designed to care for the sewage from the Gedney Farm Hotel, were approved. These plans provided for the discharge of effluent from the disposal plant into a covered brook tributary to the Mamaroneck river. The permit issued in connection with the approval of these plans limited the sewage to be passed through the plant to that contributed by 150 persons unless the sewage disposal works should be increased in accordance with plans approved by this Department.

Investigations made since the construction of this plant have shown that the plant has, at times, been overtaxed. The inspection of the plant made on July 7, 1914, in connection with the general investigation of conditions of sewage disposal plants in the State, showed that in addition to the plant being overtaxed there were two houses in the northwestern portion of the property connected with a sewer which discharged into a cesspool provided with an overflow into the brook. The report on this investigation, dated July 20, 1914, copies of which were sent to the Gedney Farm Company, pointed out the necessity for limiting the number of persons served by the plant to 150 and recommended that the plant be enlarged and that certain other changes be made. It was also pointed out to the Gedney Farm Company that the discharge of sewage from the cesspool referred to was a direct violation of section 76 of the Public Health Law and the company was advised that plans for the disposal of the sewage from the houses not connected with the disposal plant should be submitted for approval.

On December 17, 1914, a hearing was held in the matter of the discharge of sewage from the property of the Gedney Farm Company, more especially from houses not connected with the disposal plant. Subsequent to this hearing an order was served on the company notifying them of the violation of the Public Health Law and requiring the discontinuance of the discharge of the sewage into the stream.

The plans now presented were submitted in compliance with this order and show that it is proposed to pump the sewage collected by the sewers in the lower portions of the Park drive and Heatherbloom road into one of the sewers tributary to the hotel sewage disposal plant. Although the houses are not shown on the plans, it is stated in the report of the designing engineer that there are at present five houses connected with these sewers and that another house which is now under construction will probably be completed in the spring and connected with the sewers. Assuming even five persons per house, the additional population to be cared for by the disposal plant will be thirty. It is stated in the report of the engineer that the proposed method of caring for the sewage is to be a temporary expedient inasmuch as bills have been introduced into the Legislature providing for the incorporation of the city of White Plains, in which event this property would be within the city limits.

The sewage from the houses referred to upon reaching the disposal plant will pass through a small rectangular screen chamber containing a wire basket screen, and it appears from the report of the engineer that the screenings deposited in this screen will be collected and disposed of outside of the watershed area each day. Owing to the small mesh of the screen, it is important that it should be cleaned regularly and at frequent intervals in order to prevent clogging and the consequent backing up or overflow of the sewage.

The pumping station, which is to be covered, is circular in plan and is to be equipped with a submerger 2-inch centrifugal pump operated by a 2 horse power electric motor The pumping equipment is to be provided with an automatic starting and stopping device operated by a float in the pump well. The sewage is to be discharged through some 1,700 feet of 2½-inch force main into one of the sewers leading to the existing disposal plant. The operating platform on which the motor is located is lower than the elevation of the ground outside of the pump house, and if constructed as shown the motor would be submerged and become almost inaccessible for repairs in case of a breakdown of the pump or motor. The operating platform and motor should be placed above the ground level at the pumping station where it would always be accessible.

As noted above, the number of persons served by this plant will be increased by about thirty. The plans, however, show that the area of the sand filters has been increased by about 50 per cent. by making each of the two beds 12½ feet wider, thereby providing for two filter beds 100 feet by 37½ feet, instead of two beds 100 feet by 25 feet, as shown by the approved plans. I am of the opinion that the number of persons served by the plant may therefore be increased by 50 per cent. in view of the increased area of the sand filters.

In conclusion, I would state that it appears that steps are being taken to incorporate the town of White Plains into the city of White Plains, in which event the sewage will probably be cared for by the city system and that the present proposition is, therefore, a temporary measure and could be approved as such. I believe that the present sewage disposal plant as enlarged, if operated with care and efficiency, should care for a population of some 225 persons. The proposed installation will, moreover, remove the overflow conditions from the houses in the northwestern part of the property and should remove a serious source of pollution of the Mamaroneck river, which is used as a source of water supply by the village of Mamaroneck and other municipalities in that vicinity.

I would, therefore, recommend that the plans be approved and a permit be issued allowing the discharge into the brook tributary to the Mamaroneck river of sewage from the six houses in the northwestern part of the Gedney farm property after such sewage shall first have been passed through the sewage disposal plant which now serves the hotel. I would further recommend that the permit contain in addition to the usual revocation and modification clauses the following conditions:

1. That the amount of sewage to be passed through the sewage disposal works be limited to that contributed by 225 persons unless the capacity of said disposal works shall be again increased in accordance with plans approved by this Department.
2. That the motor in the pumping station shall be placed above the elevation of the ground.
3. That whenever required provisions shall be made to duplicate the pumping equipment and to secure an additional source of power.

Respectfully submitted,

THEODORE HORTON,
Chief Engineer

ALBANY, N. Y., *March* 11, 1915

PERMIT

Application having been duly made to the State Commissioner of Health, as provided by section 76 of chapter 49 of the Laws of 1909, the "Public Health Law," as amended by chapter 553 of the Laws of 1911, constituting chapter 45 of the Consolidated Laws, permission is hereby given to The Gedney Farm Company, Inc., to discharge effluent from the sewage disposal works to treat the sewage from the Gedney Farm Hotel and from several cottages northwesterly from said hotel into the waters of a tributary of Mamaroneck river as shown by the plans within the town of White Plains in accordance with the plans accompanying the petition, under the following conditions:

1. That this permit shall be revocable at any time or subject to modification or change when in the judgment of the State Commissioner of Health such revocation, modification or change shall become necessary.
2. That the issuance of this permit shall not be deemed to affect in any way action by this Department on any future application that may be made for permission to discharge additional sewage or effluent into the waters of this State.
3. That the sewage disposal works shown by plans approved this day shall be fully constructed in complete conformity with such plans or approved amendments thereof.

4. That only sanitary or domestic sewage and no storm water or surface water from streets, grounds, roofs or other areas shall be admitted to or passed through the sewage disposal works.

5. That no sewage sludge from any part of the disposal works shall be discharged into the tributary of the Mamaroneck river or any other watercourse or body of water.

6. That the electric motor in the pumping station shall be placed at an elevation above the elevation of ground surface.

7. That the amount of sewage to be passed through the sewage disposal works is hereby limited to that contributed by 225 persons unless the capacity of such sewage disposal works shall be increased in accordance with plans approved by this Department.

8. That effective chlorination of the effluent from the sand filters shall be provided at all times by the proper application to such effluent of not less than ten parts of available chlorine per million parts of sewage treated.

9. That whenever required by the State Commissioner of Health a duplication of both the pumping and power equipments at the pumping station or additional and auxiliary pumping and power equipments shall be provided.

HERMANN M. BIGGS,
State Commissioner of Health

March 11, 1915

YORKTOWN HEIGHTS (Sarah J. Bird Memorial Farm)

HERMANN M. BIGGS, M.D., *State Commissioner of Health:*

Detail plans for sewage disposal for the Sarah J. Bird Memorial Farm near Yorktown Heights, Westchester county, were submitted to this Department for approval on July 9, 1915.

The farm is located on the Putnam division of the New York Central and Hudson River railroad, about two miles south of Yorktown Heights and one mile north of Croton lake. A number of small streams tributary to this lake flows through the property. The farm is to be used for furnishing temporary employment for men out of work and it is expected to be self-supporting. It is estimated that the average maximum population of the farm will not exceed twenty-five.

The general topographical map of the property showing the location of the buildings and a tentative location of two cesspools was submitted for approval on April 16, 1915. After a preliminary examination of these plans the representatives of the institution were advised that the plans did not contain sufficient details to permit of an intelligent examination of them and that comprehensive and detail plans for sewage disposal for the institution should be prepared and submitted for approval.

The plans now submitted were prepared by Hering & Gregory, consulting engineers and sanitary experts of New York city, and comprise duplicate copies of six sheets showing general and detail plans of the sewage disposal plant together with duplicate copies of reports and specifications. The report of the engineers states that the sewage disposal plant is designed to serve a population of 25 with an estimated daily flow of 60 gallons per capita.

The sewage from the institution is to be collected by a 6-inch sewer and conveyed by gravity flow to the proposed sewage disposal plant, consisting of a settling tank, valve or diverting chamber and subsurface irrigation system located about 200 feet from the nearest building. The plant is to be situated about 700 and 1,000 feet respectively from two streams tributary to Croton lake. There is a ridge between the plant and the nearer of the two streams and the slope of the ground is from the plant toward the stream located 1,000 feet away.

The design of the tank is similar to that of an ordinary manhole. It is circular in plan, 5 feet in diameter and about 10 feet deep with a depth of about 6 feet below the flow line. It has a capacity of about 880 gallons

and would give 14 hours detention of the sewage on the basis of the design used. It is to have a submerged inlet and a submerged outlet and is to be provided with a 24-inch manhole through which the sludge and scum which will accumulate in the tank may be removed.

It is important that the tank should be cleaned at least twice during the year. The sludge and scum removed from the tank should be buried as far from any stream as possible and in such a manner as to prevent any possible pollution of the New York city water supply.

From the settling tank the effluent is to be discharged into a diverting manhole having three outlets through which the effluents to be discharged into the different sections of the subsurface irrigation system. Each outlet is to be provided with the stop flow so that any one of the three portions of the irrigation system may be thrown out of use for resting when necessary.

The irrigation system is to contain about 700 feet of 4-inch glazed tiles 12 inches long and laid with ¼-inch open joints. According to the report of the engineers, each joint is to be wrapped with burlap and surrounded with fine screened gravel. The lines of tile are to be laid at a depth of 18 inches below the surface of the ground and are to be spaced 8 feet center to center. Two of the main distributing lines are to be laid on a slope of 6 per cent. and the other main is to have a slope of about 9 per cent. The slope of the lateral lines is in all cases to be .5 per cent.

The system provides for about 30 feet of tile per person and the average rate of operation will be about 10,000 gallons per acre per day assuming a daily per capita rate of water consumption of 60 gallons. No definite data as to the nature of the soil at the site have been submitted, but if the rate of operation is found to be too high the system is so designed that it can be readily extended by adding more lines of tile.

In conclusion I would state that it would appear from our careful examination of the plans that the proposed sewage disposal plant, if properly constructed in accordance with the plans and if operated with care, should satisfactorily care for the sewage contributed by a population of 25 persons. Whenever the maximum sewage population at the farm tributary to the plant shall exceed 25, the sewage disposal plant should be extended in accordance with plans, satisfactory to this Department.

I would therefore recommend that the plans be approved on condition that whenever the average maximum population served by the plant at the farm shall exceed 25, or whenever required, the proposed sewage disposal plant shall be extended or enlarged in accordance with plans which must first be submitted to and approved by this Department.

Respectfully submitted,
THEODORE HORTON,
Chief Engineer

ALBANY, N. Y., *June* 21, 1915

The plans were approved on July 31, 1915.

YORKTOWN HEIGHTS (N. Y. State Training School for Boys)

ALBANY, N. Y., *July* 27, 1915

HON. LEWIS P. PILCHER, *State Architect, Albany, N. Y.:*

DEAR SIR.— On March 16, 1915, you submitted to this Department plans for sewerage and sewage disposal works for the New York State Training School for Boys at Yorktown Heights. These plans show that the works will consist of:

1. A set of Imhoff tanks for sedimentation with a capacity of three hours flow of sewage allowing 150 gallons per capita.
2. Sand filter beds, for filtration, of an area sufficient for the passage of 50,000 gallons per acre per day, based on a daily flow of 100 gallons per capita.
3. Terminal disinfection with liquid chlorine.

They provide that the effluent from this plant shall be discharged beneath the surface of the waters of Mohansic lake. The system proposed furnished adequate provision for sedimentation and sand filtration and terminal chlorination, and is in accordance with the sewage disposal works recommended for this institution by a commission of experts consisting of Dr. T. Mitchell Prudden, Dr. William H. Park, Professor C.-E. A. Winslow, Professor Henry N. Ogden and George C. Whipple.

Past experience has shown that similarly constructed sewage disposal plants can be successfully operated so as to deliver effluents which are practically sterile. In view of these facts and furthermore since this plant when built in accordance with your plans must be properly operated under the advice and direction of this Department, I return the plans to you approved with certain conditions as stated below. These conditions are appended because the population upon the Croton watershed is steadily increasing, and since it seems probable that the waters of Mohansic lake and Crom pond will be needed in the future for water supplies. The institutions proposed will largely increase the population upon this watershed.

Furthermore, all these watersheds must be protected from any possible pollution, and with an increasing population this will become more and more difficult. Therefore the approval of the plans and the conditions under which such approval is given contemplates in the early future with the development of these institutions the conveyance of the effluent from the proposed sewage disposal plant to a point outside of the limits of all of these watersheds. Investigations by Mr. Nichol of your Department and Mr. Horton, chief engineer of this Department, have shown that such a plan is practicable.

The approval of the plans is therefore granted subjected to the following conditions:

1. That the approval of these plans is considered to be temporary only, and that it contemplates eventually the conveyance of the effluent from the proposed sewage disposal works to a point outside of the limits of these watersheds.
2. That the approval of these plans shall be limited to a period of one year from the date when the sewage disposal works are first placed in operation unless such time limit is extended by the State Commissioner of Health.
3. That the approval of these plans shall be revocable at any time or subject to modification or change when, in the judgment of the State Commissioner of Health, such revocation, modification or change may be necessary.
4. That the approval of these plans shall not be deemed to affect in any way action by this Department on any future application that may be made for permission to discharge additional sewage or effluent into the waters of this State.
5. That both the sewer system and the sewage disposal works shown by plans approved this day shall be fully constructed in complete conformity with such plans or approved amendments thereof.
6. That only sanitary or domestic sewage and no storm water or surface water from roads, grounds, roofs or other areas shall be admitted to the proposed sewers.
7. That no sewage sludge from any part of the disposal works shall be discharged into Mohansic lake, Crom pond or any watercourse or body of water.
8. That the installation and subsequent operation of the plant shall be at all times satisfactory to this Department.
9. That regular reports of the operation of the plant shall be submitted to this Department in such form and at such times as may be required.
10. That at all times the sand filters shall have an area of one acre to 500 population and that the effluent from the sand filters shall be properly disinfected at all times by chlorination, using not less than five parts of available chlorine per million parts of sewage.
11. That whenever required the discharge of effluent from the works

into the Mohansic lake shall be discontinued and such outlet pipe and other works as may be necessary shall be constructed to properly convey the effluent from the works to some other point, and when required outside the Croton watershed.

Yours very truly,

HERMANN M. BIGGS,
State Commissioner of Health

ALBANY, N. Y., *September* 29, 1915

HON. LEWIS P. PILCHER, *State Architect, Albany, N. Y.:*

DEAR SIR.— I beg to acknowledge the receipt of your letter of September 29, 1915, transmitting for my approval Addenda No. 1 to Specifications No. 2225, together with the accompanying plans Nos. 2015, 2016, 2017, 2022, 2023 and 2024, covering sewerage and sewage disposal plant for the New York State Training School for Boys at Yorktown Heights, three of these plans, viz., Nos. 2022, 2023 and 2024, being modifications and amendments of plans for sewage disposal for this institution submitted by you on March 16, 1915, and approved by me on July 27, 1915, upon the conditions stated in the letter addressed to you on that date.

It is my understanding that the plans approved by me on July 27, 1915, were amended in order to provide for a population considerably less than the ultimate population provided for by the plans approved on July 27, 1915. The plans now submitted comprise generally:

1. An Imhoff tank for sedimentation with a capacity of three hours flow, allowing 150 gallons per capita for a population of 500 persons.
2. Three sand filter beds for filtration of sewage at a rate of 50,000 gallons per acre per day based upon a daily flow of 100 gallons per capita for a population of 375.
3. Terminal disinfection with liquid chlorine provided for in a temporary structure.
4. An effluent pipe discharging beneath the surface of the waters of Mohansic lake.

Since the method of treatment provided by the present plans is substantially in accordance with that shown by the plans approved by me under date of July 27, 1915, the amended plans are herewith approved under the conditions specified in my letter to you of said date.

Yours very truly,

LINSLY R. WILLIAMS,
Deputy State Commissioner of Health

INDIVIDUAL PERMITS ISSUED DURING 1915, UNDER SECTIONS 76 AND 78 OF CHAPTER 49 OF THE LAWS OF 1909, THE PUBLIC HEALTH LAW, CONSTITUTING CHAPTER 45 OF THE CONSOLIDATED LAWS

LOCATION	To whom issued	Date, 1915	Waste matter	Discharged into
Adams Center, Jefferson county	American Milk Co., Inc.	Mar. 29	Effluent from settling tank to treat waste water and washings from condenser.	Averill's creek.
Alden, Erie county	Board of Supervisors of Erie county.	Mar. 29	Effluent from sewage disposal plant at Erie County Farm (see page 21 of this report).	Ellicott creek.
Altamont, Albany county	Board of Managers, Y. W. C. A. Camp.	Oct. 13	Effluent from sewage disposal works at the Y. W. C. A. Camp (see page 26).	Black creek.
Aurora, Cayuga county	Wells College	Sept. 24	Effluent from two sewage disposal plants at the College (see page 31).	Cayuga lake.
Burke, Franklin county	Mutual Milk & Cream Co.	Mar. 29	Effluent from settling tank to treat waste water and washings from creamery.	Little Trout river.
Callicoon, Sullivan county	Ketches Dairy Co.	Sept. 3	Effluent from settling tank to treat waste water and washings from creamery at Youngsville.	Callicoon creek.
Clay, Onondaga county	J. Weller Co. & Ward A. Moulton	Oct. 5	Effluent from settling tanks to treat waste water and washings from kraut factories of said companies.	Shavers creek.
Farnham, Erie county	Fort Stanwix Canning Co.	April 13	Effluent from sewage disposal works to treat sewage and wastes from canning factory (see page 90).	Mud creek.
Gowanda, Cattaraugus county	C. Moench Sons Co.	Sept. 17	Effluent from works to treat wastes from tannery (see page 96).	Cattaraugus creek.
Hudson, Columbia county	Leander H. Weaver	May 27	Effluent from sewage disposal plant to treat sewage from Fairground Boulevard district (see page 104).	Tributary to Hudson river.
Hunter, Green county	Max Blum	Feb. 17	Effluent from settling tank to treat waste water and washings from creamery.	Schoharie creek.
Liberty, Sullivan county	Parksville Dairy Co.	July 2	Effluent from settling tank to treat waste water and washings from creamery.	A brook near creamery.
Lisbon, St. Lawrence county	Sheffield Farms - Slawson, Decker Co.	Aug. 20	Effluent from settling tank to treat waste water and washings from creamery.	Tributary to Sucker brook.
North Hempstead, Nassau county.	R. N. L. Church	April 14	Effluent from sewage disposal plant to treat sewage from property at Hewlett Point (see page 144).	Long Island Sound.
North Hempstead, Nassau county.	Isaac Guggenheim	Aug. 20	Effluent from sewage disposal works to treat sewage from estate (see page 136).	Hempstead harbor.
Nunda, Livingston county	H. Dolfinger	July 28	Effluent from settling tank to treat waste water and washings from dairy.	Keshequa creek.
Oyster Bay, Nassau county	North Shore Country Club	April 19	Effluent from disposal plant to treat sewage from club (see page 152).	Hempstead harbor.
Oyster Bay, Nassau county	H. L. Pratt	Aug. 11	Effluent from disposal plant to treat sewage from residence (see page 154).	Long Island Sound.
Pine Bush, Orange county	Borden's Condensed Milk Co.	Jan. 15	Effluent from works to treat waste water and washings from pasteurizing plant (see page 161).	Tributary of Dwaar Kill.

INDIVIDUAL PERMITS ISSUED DURING 1915, ETC. — *Continued*

LOCATION	To whom issued	Date, 1915	Waste matter	Discharged into
Santa Clara, Franklin county....	Upper Saranac Association....	Dec. 14	Effluent from sewage disposal works to treat sewage from Saranac Inn (see page 185).	A swamp.
Shavertown, Delaware county....	Mountain Side Dairy Co.....	March 3	Effluent from settling tank to treat waste water and washings from creamery.	East Branch, Delaware river.
Sodus Point, Wayne county......	James Harris...............	March 16	Effluent from settling tank to treat sewage from the Harris hotel.	Great Sodus bay.
Watertown, Jefferson county.....	Lafayette Polley............	Dec. 14	Effluent from settling tank to treat waste water and washings from Watertown valley cheese factory.	Swamp.
Webb, Herkimer county.........	L. W. Brown...............	May 3	Effluent from sewage disposal plant from property of Mr. Brown.	Big Moose lake.
Westfield, Chautauqua county....	Armour & Co..............	Sept. 3	Effluent from works to treat wastes from grape juice plant (see page 209).	Lake Erie.
Westfield, Chautauqua county....	Welch Grape Juice Co.......	Sept. 3	Effluent from works to treat wastes from grape juice plant (see page 209).	Lake Erie.
White Plains, Westchester county.	Gedney Farm Co., Inc.......	March 11	Effluent from sewage disposal works to treat sewage at Gedney farm property (see page 212).	Tributary of Mamaroneck river.

GENERAL INVESTIGATIONS RELATING TO SEWERAGE AND SEWAGE DISPOSAL

The problem of properly providing for the collection and disposal of sewage affects very closely the health and sanitary condition of a municipality. This important matter is, however, in many cases, either entirely neglected or inadequate and inefficient methods are employed. From this neglect result unhealthful, insanitary, noisome conditions to which the attention of this Department is called either through direct complaints or by the local authorities who request assistance in meeting the problem.

A thorough investigation of the municipality is made by an engineer of this Department and a report prepared in which are pointed out the proper steps to be taken to provide a permanent remedy. Although this Department is without the power to compel the installation of systems of sewerage and sewage disposal and consequently the completion of its work is curtailed, yet, in many instances effective action is taken by the local authorities on the advice and at the instigation of this Department.

The reports of the investigations made by this Department in the more important cases which have come before it during 1915 are given below and a list is appended of all other cases.

ALTAMONT

HERMANN M. BIGGS, M.D., *State Commissioner of Health:*

An investigation of conditions of nuisance in the incorporated village of Altamont, Albany county, which were the subject of complaints made to this Department by two residents of the village was made on May 19, 1915, by Mr. C. A. Howland, assistant engineer.

The records of this Department show that repeated complaints have been received in regard to conditions of nuisance existing in Altamont as the result of improper methods of disposing of sewage. Plans for a comprehensive system of sewers and sewage disposal works were approved by this Department on August 19, 1907, but during investigations made in 1912 and 1913 it was found that no part of the approved system had been built. In the reports of this investigation it was recommended that the insanitary conditions be remedied by installing properly constructed sewers in accordance with the plans approved by this Department.

Altamont is an incorporated village of some 736 population situated on the Delaware & Hudson R. R. about 17 miles west of Albany. The population is purely residential as there are no factories situated in the village. A public water supply derived by gravity from streams west of the village is available and it was estimated that about 75 per cent. of the houses have installed the village water although there are about 60 wells still in use in the village. About 40 per cent. of those supplied with the water have installed flush closets and other modern plumbing fixtures, i. e., about 30

per cent. of the total population. There is therefore a considerable amount of sewage of which disposition must be made.

This sewage is disposed of in several ways, the principal method being to discharge it into septic tanks, built with three compartments. An average tank it was stated will be about 4 feet x 10 feet x 5 feet deep below the flow line. The third of the three compartments is filled with layers of stone, charcoal and gravel and the effluent is discharged either into a system of subsurface irrigation tile pipes, into a series of excavations filled with stone or into a nearby drain or watercourse. From 6 to 8 of these septic tanks were built during the past spring it was stated, at an estimated average cost of $75 each, including all work outside of the buildings.

Two storm sewers have been constructed one on each side of Main street from a point above Prospect avenue to a small stream or drainage ditch east of Indian Ladder road. These sewers were the subject of an inspection in 1912 and it was learned at that time and also upon the present inspection that the overflow from septic tanks, etc., is discharged into these sewers. Complaint has been made to the Department in regard to obnoxious conditions near the outlets of these sewers.

Mr. Justin L. Smith, a resident of Lincoln avenue, made a complaint to this Department regarding the discharge of sewage into an open ditch near his property and the engineer, at the time of the present investigation, inspected the conditions with him. It was found that a ditch which showed evidences of receiving domestic wastes passes in the rear of the Smith property to a larger ditch. This larger ditch is open from Maple street to a point east of Lincoln avenue, except at Lincoln avenue, but for a considerable distance above Maple street it is covered. The condition of the bed of the ditch especially near the outlets of several drains which discharge into it, indicated that it receives wastes containing sewage. Toilet paper was found near the outlet of a drain east of Lincoln avenue, indicating that the sewage from this place is not passed through a settling tank. This ditch is located in the vicinity of a number of houses and stores and odors arising from it would affect a considerable number of persons. Mr. Smith stated that the odor emanating from the ditch is obnoxious at his house although at the time of the inspection probably due to the considerable volume of flow in the ditch and to the atmospheric conditions the odors were not so marked.

The engineer also observed wastes lying in the gutter along the west side of Lincoln avenue north of the Livingston place. These wastes, from which a foul odor arose, are discharged, it was stated, from a bakery located nearby.

Another ditch, which was the subject of an inspection made in 1913, discharges near a culvert under Lincoln avenue at a point north of the bakery above mentioned. Practically the same conditions existed at this time as at the time of the previous inspection, with the exception that the ditch extending northward on the east side of Lincoln avenue had been apparently cleaned out and the wastes allowed to flow northward and thence eastward through boggy land to pools located near a creek which was dry.

Mr. J. P. Livingston residing on Main street near the corner of Lark street made a complaint to this Department regarding a ditch along Lark street. The engineer investigated the conditions in company with Mr. Livingston and found that sewage from three buildings including a bank discharges into an open ditch which passes easterly and connects with the gutter along the west side of Lark street. A drain also discharges into the ditch just above the street gutter and it was also stated that one other house situated further south on Lark street discharges wastes into the gutter. The sewage passes northerly along the gutter to a catch basin near the corner of Main street and this catch basin is connected with the large sewer on the south side of Main street described above. The conditions in this ditch indicated that if the sewage is passed through septic tanks the treatment is not sufficient to prevent a nuisance affecting a considerable number of persons arising from the discharge of sewage into this ditch. In any event such discharge of septic tank effluent without a permit is in violation of the Public Health Law.

From the above inspection it appears that there are existing in the village of Altamont insanitary conditions which not only endanger the health of the residents but are a continual source of public nuisances. It is also

obvious that all of these insanitary conditions are directly traceable to the absence of properly constructed and adequate sewers in the village. The individual disposal plants where installed do not, in all cases, afford a degree of treatment of the sewage sufficiently complete to prevent the creation of nuisances in the ditches and streams into which the effluent from these plants discharge and, as pointed out above, the discharge of effluent from such tanks is unwarranted and illegal.

The engineer was informed that the village authorities intend to install a tile drain to care for the sewage which now flows into the gutter along the east side of Lincoln avenue. The construction of any sewers not in accordance with the plans approved by this Department is illegal. Sewers should be installed to care for all of the sewage of the village but these sewers should be so constructed that they will be permanent and adequate for all needs resulting from future growth, and will dispose of the sewage in such a manner that a nuisance will not be created at any point. It may be pointed out that complaints have been made in regard to the sewers which have already been constructed, because no provision was made for disposing of the sewage, finally, in a manner which will not create a nuisance.

An examination of the conditions also indicates that the method pursued in the village has been uneconomical because the expense incurred in the construction of individual disposal plants could much better be spent as a part of the expense of an adequate and well constructed sewer system from which permanent results could be expected. These individual expenditures would pay the yearly payments of the property for a number of years on a bond issue to construct sewers.

This is entirely aside from the depreciation to property resulting from the lack of proper sewerage facilities and the existence of obnoxious nuisances.

In view of the above factors I would recommend that the village authorities of Altamont be advised that a proper sewerage system and disposal plant be constructed for the village. This recommendation, which has been made repeatedly, has been borne out by the experience of the village. Until this is done, the conditions will become more aggravated with time not only endangering the health of the people of the village through the danger of the spread of communicable diseases but also blocking the growth of the village itself. Plans for a comprehensive sewer system and for a comparatively inexpensive sewage disposal plant have already been approved by this Department.

I would also recommend that the attention of the village authorities be called to section 76 and subsequent sections of the Public Health Law which prohibit the discharge of sewage into a watercourse of the State without the permission of the Commissioner of Health.

In conclusion I would recommend that copies of this report be transmitted to the village authorities and that they be advised to carry out the recommendations of the report.

Respectfully submitted,

THEODORE HORTON,
Chief Engineer

ALBANY, N. Y., *May* 22, 1915

ATHENS

HERMANN M. BIGGS, M.D., *State Commissioner of Health:*

An investigation of insanitary conditions in the incorporated village of Athens, Greene county, was made on May 13, 1915, by Mr. C. A. Howland, assistant engineer, at the request of the village authorities.

The records of this Department show that as early as 1898 insanitary conditions in the village of Athens were investigated by a representative of this Department. An investigation was also made on May 6, 1912, in regard to several complaints of insanitary sewerage conditions and it was pointed out to the village authorities that a sewerage system and sewage disposal plant should be constructed.

The village of Athens is situated upon the west bank of the Hudson river, about 28 miles south of the city of Albany, and opposite the city of Hudson. It is reached by ferry from Hudson, the nearest railroad station on the same side of the river being about two miles distant. An examination of the census records shows that the population of the village reached its maximum in 1875, when it numbered 3,467, and that it has decreased steadily since that time, except for the decade from 1890 to 1900, when there was a slight increase. The population in 1910 was 1,956 and it is estimated that the present number is under 2,000. It is interesting in this connection to compare the census figures for Athens and those for Hudson, which for many years has been provided with modern facilities that the village of Athens lacks. With one exception the city shows a steady increase in population since 1865.

A number of business enterprises are located in Athens including a knitting mill, composite metal lath plant, and ice tool manufacturing company, and attention has apparently been given to municipal improvements such as paving and lighting, but the village is not provided with a public water supply or sewer system. Because of the lack of a water supply it is necessary for the factories which need water to pump it from the Hudson river. A system for obtaining water for fire purposes has been installed in the village and this consists of pumping by means of fire engines to cisterns located at different points about the village. In case of fire, water is pumped from the cisterns and the engineer was informed that the cistern is usually pumped dry.

Water for domestic purposes is obtained chiefly from wells which in some instances are supplemented by pumping from the river. About ten houses in the village have installed a compressed air system of water distribution and others use attic tanks. Some depend largely on rain water collected in cisterns which are partitioned by a brick wall through which the water percolates.

Modern plumbing fixtures, including flush closets, have been installed in a number of the houses and hotels and in many of the other places kitchen sinks are used. The use of these fixtures results in the development of a considerable amount of sewage which is disposed of in several ways. As the village is not supplied with properly constructed sewers to care for the domestic sewage, the sewage is in many cases discharged into the existing storm sewers, drains and ditches. Kitchen wastes are, in many cases, discharged directly into the gutters along the streets or into drains which discharge into the gutters, and the engineer observed one place where the kitchen wastes discharge into a tub which is emptied into the gutter. When the above methods are not practicable cesspools are used. The engineer was informed that because of the nature of the soil which, although gravelly in some places, consists of blue clay in others, it is frequently necessary to clean out these cesspools and to dig others when the soil becomes clogged. It was estimated that from 25 to 35 per cent. of the population uses cesspools. A majority of the houses in the village have no flush closets and are, therefore, dependent on privies.

During a general investigation which was made of the village the engineer observed many instances where the methods of sewage disposal above described produced conditions which are unsightly and give rise to foul odors which are the subject of repeated complaints to the local health authorities and also endanger the health of the residents.

A stone drain between Franklin and Washington streets discharges at the south side of Market street and the sewage flows through an open ditch to Washington street, along which it passes to a culvert under the road. The wastes lie in a pool above the culvert and in the ditch. A foul odor was noticed arising from them. At the time of the inspection made in 1912 a sewer was described which emptied into a street between Washington street and the river. The engineer found at the time of the present inspection that sewage was still discharging from this sewer and lay in a pool in the road. A nearby resident complained of the odors arising from this sewer and stated further that his daughter had suffered recently from typhoid fever.

The engineer was informed that a storm sewer in Second street with which connections have been made for flush closets is not laid at a depth sufficient to drain properly the cellars of the buildings and that the sewage backs up in the cellars. Trouble has also been experienced with obnoxious odors arising from the street inlets of the storm sewer. This has been remedied, partially at least, by installing flap valves at the inlets.

The engineer also found upon investigation that the privies in many instances are improperly constructed and neglected to such an extent as to become obnoxious through the foul odors which arise from them and are so constructed as to constitute a menace to the health of the people. In some parts of the village the privies must from necessity be placed close to the buildings, which has been the cause of frequent complaint in regard to nuisance. The privies in many instances are not properly screened, so that flies have access to them. There is also a serious danger in the fact that the privies are in some instances located near wells and cisterns from which water is derived for domestic purposes.

From the above investigation it is evident that the conditions resulting from the absence of a public water supply and sewerage system in the village of Athens are such as to not only seriously endanger the health of the people but to be a continued source of nuisance. Upon inquiry the engineer was informed that the cases of typhoid fever and other diseases of this kind are few and some in the village assume that this will always be the case, but there are numerous examples which may be cited from the experience of this Department to show that, if this condition exists it is more the result of good fortune than the adequacy of the protection against communicable disease.

It is obvious that to improve properly the conditions which at present give rise to obnoxious and unhealthful conditions through the discharge of sewage into the streets, insanitary privies, etc., will require the expenditure of money either by the village or individuals. It is also apparent that those persons who desire the convenience and protection against disease afforded by modern plumbing and proper sewage disposal can at present obtain them only at considerable cost and are thus confronted with the problem of disposing of the sewage without offense or danger to the health of themselves or their neighbors. Business enterprises which require considerable volumes of water cannot locate in the village unless they pump their water from the river, which entails not only the original cost of pump and mains but the continual cost of pumping.

Connections which are made with the existing storm sewers are also in violation of the Public Health Law, which requires that permission for the discharge of sewage into the waters of the State must be obtained from the State Commissioner of Health.

In view of the above, it is apparent that to protect the health of the village adequately, and permanently remove the numerous sources of nuisance, the village of Athens should take steps to install a public water supply and sewerage system. A competent engineer should be employed to determine, by making the proper studies and investigations, the most economical method of obtaining water and providing sewers and sewage disposal. A project for obtaining a public water supply must be approved by the Conservation Commission and plans for sewerage and sewage disposal must be submitted to this Department for approval and also to the Conservation Commission. In regard to sewerage, while the Village Law requires that plans shall show a comprehensive sewer system covering the whole village, yet with the permission of this Department parts of the system which are at present unnecessary may be temporarily omitted from the construction.

In conclusion I would recommend that copies of this report be transmitted to the village authorities and that they be urged to take steps toward providing an adequate and safe public water supply and a proper system of sewers and sewage disposal for the village at the earliest possible date.

Respectfully submitted,

THEODORE HORTON,
Chief Engineer

ALBANY, N. Y., *May* 20, 1915

BINGHAMTON (State Hospital)

HERMANN M. BIGGS, M.D., *State Commissioner of Health:*

An inspection of the sewerage system of the Binghamton State Hospital with special reference to the surcharging during times of storm of the Court street sewer in the city of Binghamton to which the hospital sewer system is tributary was made on November 9, 1915.

On August 11, 1915, a communication was received from the city engineer of Binghamton stating that on July 7 and 8 an unusually heavy rain storm occurred during which there was a total precipitation of 4.19 inches in 24 hours and that this storm caused the portion of the sewer system in Court street below Fairview avenue to be congested with sand and gravel washed down by the hospital sewer with the result that diluted sewage overflowed from the manhole at the intersection of Fairview avenue and Court street, flowed over the street and found its way into the Susquehanna river above the intake of the water supply of the city of Binghamton. The washing down of the sand and gravel into the Court street sewer was attributed to the improper construction of the catch basins on the hospital grounds. A copy of an act of the Legislature approved by the Governor on May 6, 1891, was submitted by the city engineer.

It appears from this act that the Legislature appropriated $50,000 or as much thereof as may be necessary for the purpose of paying one-half of the cost of construction of the sewers from the premises of the Binghamton State Hospital in the city to a point below the rock bottom dam on the Susquehanna river upon plans and specifications to be prepared by the city authorities of Binghamton and to be approved by the State Engineer and Surveyor. It also provided that all future costs for the care and maintenance of this sewer shall be borne by the city.

Subsequent to the receipt of this communication from the city the matter of sewer construction at the hospital was taken up with the Hospital Commission and it was arranged that an inspection should be made by one of the engineers from this Department and a representative of the Hospital Commission.

The inspection was accordingly made on November 9, 1915, by Mr. C. A. Holmquist, assistant engineer of the Department, in company with Mr. Charles B. Dix of the Hospital Commission; Mr. J. A. Giles, city engineer, and the steward of the hospital. The superintendent of the institution was also interviewed with reference to the construction and operation of the sewer system.

The hospital is located on the north side of the Susquehanna river in the extreme westerly section of the city. It has at present a population of about 3,000 including patients and employes.

The sewer system of the hospital consists of a number of branch sewers which extend from the different buildings of the institution and discharge into two trunk sewers. One of these sewers is 8 inches in diameter and the other is a 15-inch sewer. Both of these sewers unite at a manhole in the westerly portion of the institution grounds and discharge into the upper end of the Court street sewer in the city of Binghamton.

The hospital sewers were constructed on the combined plan and take the rain water from the various buildings and some storm water from the drives on the grounds in addition to the sanitary sewage. Most of the storm water, however, which falls on the drives and grounds of the hospital, finds its way through gutters and over the surface of the ground into two small intermittent streams, one of which flows through the westerly portion of the grounds and the other through the easterly portion of the grounds and discharge into the Susquehanna river.

The majority of the catch basins shown by the plans of the sewer system on file in this office do not discharge into the sewers as shown by the plans but discharge onto the surface of the ground adjacent to the drives. In fact none of the catch basins along the westerly and southerly drives were found

to connect with the sewer. It is found that only seven catch basins of those shown by the plans are connected with the sewers, namely, two east of and one south of the main building; one north of the south building; one east of the green houses; one near the laundry and one near the garage east of the east building. Of these seven catch basins four were found to be properly constructed and provided with sumps for the interception of grit; one is of inadequate size; two have no sumps but are simply direct inlets to the sewers. One of the above basins, located near the south building, drains a portion of the lawn and would receive little or no gravel or sand during time of storm and the remainder of the catch basins referred to drain comparatively small flat areas and probably do not contribute to any considerable extent to the clogging of the sewers. It was learned, moreover, from the hospital officials that the catch basins are cleaned twice a year and none of those which were properly constructed were found to be full of grit.

As noted above the sewage from the hospital discharges into the upper end of the Court street sewer which was constructed jointly by the city and the hospital in accordance with the provisions of the legislative act referred to. The upper portion of this sewer from the end of the hospital sewer to Fairview avenue, a distance of about 900 feet is 15 inches in diameter and has a slope of 2.5 per cent. At Fairview avenue the sewer is changed from a circular section to an egg-shaped section, 1 foot 8 inches by 2 feet 6 inches in cross section. This section of the sewer continues to Bigelow street, a distance of about 1,200 feet and has a slope of .18 per cent. Between Bigelow and Moeller streets, a distance of about 1,400 feet, the sewer is 1 foot 10 inches by 2 feet 9 inches in cross section and has a slope of about .15 per cent. It is alleged that silting up of the Court street sewer occurs between Fairview avenue and Moeller street. The capacity of the sewer between Fairview avenue and Moeller street is practically the same as the capacity of the 15-inch house sewer between the hospital and Fairview avenue.

According to the map of the city dated 1908, and submitted in connection with plans for the interception and treatment of the sewage of the city in December, 1910, there were about 8,000 feet of lateral sewers serving the portion of the city north of Court street tributary to this sewer. Since that time about 14,000 feet of nearly three miles of sewers tributary to the Court street sewer have been added in this section which it was found has had a rapid growth during the last few years. All these lateral sewers in common with the greater portion of the sewer system of the city have been constructed on the combined plan and most of the streets served by the lateral sewers tributary to the Court street sewer are simply dirt or gravel streets.

It was found also at the time of the inspection that the culvert which carries a small intermittent stream under Court street at Fairview avenue is of inadequate capacity to care for the maximum flow in the stream during times of storm with the result that the water in the stream backs up and overflows the premises and floods the cellars of property owners near the intersection of Fairview avenue and Court street. The city engineer stated that the culvert runs in a westerly direction under the sidewalk and Court street and that there are two right angle turns in the culvert between the northerly and southerly sides of Court street. This would of course tend to decrease the capacity of the channel. The capacity of the channel is further decreased by the caving in of the sides of the conduit or culvert under the sidewalk.

It was learned that the backing up of the stream at Court street occurred last season at the same time that the overflow from the Court street sewer took place and that a mixture of sewage and storm water overflowed the surrounding premises and flooded the cellars and gave rise to very insanitary conditions. It is apparent that the culvert which carries the stream under Court street at Fairview avenue should be enlarged and that it should be carried straight or diagonally across the street in order to avoid right angle bends which would tend to decrease its capacity.

As the result of the inspection the following conclusions are reached:

1. That the sewers at the hospital have been constructed on the combined plan.

2. That two of the catch basins located near the main building have not been properly constructed and permit gravel and sand from the road to be washed directly into the sewers and thence into the city sewer in Court street and that one of the catch basins is of inadequate size.

3. That the Court street sewer is of inadequate size to care for the combined sewage of the section served by it.

4. That the surcharging and overflowing of the upper portion of the Court street sewer occur during storms causing a menace to the city water supply and insanitary conditions in the vicinity of Fairview avenue and Court street.

5. That the surcharging and filling up of the Court street sewer with grit is due in part to the improper construction or inadequate size of certain catch basins on the hospital property, but largely to the rapid development of and the extensive construction of combined sewers in improved streets in the eastern portion of the city and to the inadequate size of the Court street sewer.

6. That the culvert which carries the intermittent stream under Court street at Fairview avenue is of improper construction and inadequate size causing flooding of that section of the city near Court street and Fairview avenue during times of heavy storms.

I would, therefore, make the following recommendations:

1. That the hospital authorities reconstruct certain of the catch basins connected with the sewers which are of improper design or inadequate size.

2. That the city take steps to relieve the Court street sewer either by the construction of an additional sewer in Court street or some street parallel to Court street or by the separation of the storm water from the sanitary sewage north of Court street and east of Moeller street.

3. That a culvert of ample capacity to care for the maximum flow of the intermittent stream which crosses Court street at Fairview avenue be constructed.

Respectfully submitted,

THEODORE HORTON,
Chief Engineer

ALBANY, N. Y., *November* 27, 1915

COOPERSTOWN

HERMANN M. BIGGS, M.D., *State Commissioner of Health:*

An investigation of the pollution of the Susquehanna river by the discharge of sewage from the village of Cooperstown in Otsego county was made on August 24 and 25, 1914, by Mr. Morton F. Sanborn, assistant engineer, as a result of complaints of the pollution which have been made in the past.

General description

Cooperstown is an incorporated village and is located at the lower end of Otsego lake on the headwaters of the Susquehanna river. It is the terminal of the Cooperstown and Oneonta Branch of the D. & H. R. R. and the O. & H. Electric R. R. has a branch line to Cooperstown. It is largely a residential village although it has a few industries of which the largest is the International Milk Products Company. Cooperstown, and especially Otsego lake are well known as summer resorts. The population of Cooperstown has increased slowly, there being 2,446 people in 1905 and 2,484 in 1910, while the present population was estimated as about 2,900 with 500 additional during the summer. The village is about 1,260 feet above sea level and from 20 to 60 feet above the water of the lake. The banks of the Susquehanna river as it flows past the village are from 20 to 60 feet high and as the river passes the dam at Cooperstown there is a fall of about 10 feet

in the level of the water of the river. Hop growing is carried on to quite an extent in the surrounding country.

The unincorporated village of Phoenix Mills with about 100 population is located on the river two and one-half miles below Cooperstown and about five and one-half miles further down is the village of Milford having a population of 510. About five miles below Milford is the unincorporated village of Portlandville having a population of 150. On the Susquehanna river below Portlandville is located a large reservoir which furnishes water power for a large hydroelectric plant.

The public water supply of Cooperstown is furnished from Otsego lake by the Cooperstown Aqueduct Association. This water is taken from a point about 1,500 feet up the lake from the outlet and is pumped into the mains and reservoir and used without filtration. The average total consumption as determined at the pumping plant was about 900,000 gallons per day, with the night rate of pumping about two-thirds of that of the day. The engineer stated that he thought a large part of the water pumped was wasted on account of leaky mains and pipes. Assuming an average consumption per capita of 100 gallons together with the 100,000 gallons used at the creamery would give about 440,000 gallons as the legitimate consumption per day and the balance of 460,000 gallons per day, which is about one-half of the total pumpage, is probably wasted through the leaky mains and pipes. About 95 per cent of the inhabitants are served by the water company and the total average daily consumption per person using the water, including that used by the creamery and the leakage would be about 280 gallons per capita.

The sewer system of the village consists of about 10 miles of sanitary sewers ranging in size from 6 inches to 12 inches and the various sewers discharge through three outlets into the Susquehanna river. The main sewer serves the greater part of the village and extends along the lake front and down the river, discharging about 300 feet below the dam, at the junction of the main river with the tailrace from the waterworks station. The next outlet discharges into the river at Susquehanna Street Bridge and receives sewage from about one-third of the village. The lower outlet is from the Delaware street district and no sewage could be noticed flowing from this outlet at the time of the inspection.

The sewers are chiefly 8 inches in diameter, although the portions adjacent to the outlets are of 13-inch pipe. The capacity of the main sewer is not sufficient to carry off all the sewage that reaches it, so an overflow was built allowing the excess sewage to flow into the lake near the entrance to the river, thus relieving the upper parts of the sewer system in this district.

The approximate amount of sewage flowing at the time of the inspection was about 600,000 gallons per day as determined by measurements taken in the main sewer near the outlet. As practically all of the population is served by the sewers the per capita flow of sewage would amount to about 177 gallons per day of which about 30 gallons per capita are received from the creamery.

The plant of the International Milk Products Company is located near the railroad station in Cooperstown. This company is engaged in the shipment of milk and the manufacture of ice cream, cheese and other by-products of milk. They use from 100,000 to 125,000 gallons of water per day, of which about 30,000 gallons are taken from their own wells. The wastes from this plant are discharged into the village sewer system and consist largely of condenser water, wash water, cheese whey and other wastes, and at times may be highly organic in character.

Review of events leading to the present investigation

Previous to 1894 most of the sewage from the village flowed directly into the lake and since the public water supply was obtained from a point about 1,200 feet up the lake it was thought that the pollution of the lake water caused by the discharge of this sewage might have some effect in causing typhoid fever in the village. Plans were approved September 18, 1895, for

the extension of the sewer system and for the discharge of the sewage below the dam at the waterworks station.

As the main sewer proved to be inadequate to carry the amount of sewage contributed to it plans were approved in 1896 for increasing the size of this sewer from the lake front to the outfall but this improvement was never carried out. In 1900 plans providing for sewers in the Delaware street district were approved and in 1911 plans for a small extension of the Susquehanna street district were approved.

At various times during the past few years plans have been submitted for extensions of the sewer system, but since the plans did not fulfill the requirements and show a comprehensive system of sewers including plans for disposal works the plans were returned with the request for additional information and the corrected plans were never resubmitted for approval.

In the report on an investigation of the prevalence of typhoid fever at Cooperstown made by the chief engineer in 1909, it was pointed out that the maintenance of both the main sewer and intake water pipe in the bed of the river made a rather questionable condition for the public water supply.

Complaints have been received in the past from Phoenix Mills and Milford in regard to the pollution of the river and these complaints have arisen at times of low flow, when practically no water was being used for water power.

Flow of river at Cooperstown

Water flowing into Otsego lake finds an outlet in the Susquehanna river on which is located a dam about one-eighth mile from the lake. The level of the water in the lake is maintained at any desired elevation by means of flash boards on the dam. At this dam is located the pumping station for the public water supply and the pumps are operated by water power whenever this power is available and at other times by steam power. The river has a drainage area above the dam of approximately eighty-two square miles consisting mostly of hilly and woody areas with the low lands open and used for cultivation or for the pasturing of cattle.

The lake does not receive sewage or other wastes except as above noted at the overflow and possibly from cottages located on the shores of the lake. Below Cooperstown the river water is not used for public water supply for many miles and the river receives but little sewage as far as Oneonta by which time the river has increased considerably in size.

At the time of the inspection the water in the lake was 11 inches above the crest of the dam and 13 inches below the top of the flash boards placed on the dam. The following conditions of flow were observed at the inspection and these conditions were stated to have been the same for part of the summer. The water pumping station was being operated by steam from 7 A. M. to 6 P. M. and by water power from 6 P. M. to 7 A. M. The flow during the period when the water wheels were not running amounted to about 1½ cubic feet per second and was due to leakage through the dam and water works. The flow while the wheels were running as obtained by current meter measurements was about 62 cubic feet per second or .41 cubic feet per second per square mile. This rate is somewhat high for the average low flow, but previous to the inspection considerable rain had fallen.

The average low flow would probably be about .2 cubic feet per second per square mile and during the fall of 1908, which was an exceptionally dry period, the average flow at Collins which is about 15 miles below Cooperstown, was .057 cubic feet per second per square mile from September 7 to September 30; .11 cubic feet per second per square mile during October; .037 cubic feet per second per square mile for November and for December the average flow was .093 cubic feet per second per square mile. This gave an average of .084 cubic feet per second per square mile for the four months and is a very low record.

With an average flow of 1 cubic foot per second per square mile the total flow past Cooperstown should be 3.2 cubic feet per second which is considerably smaller than the amount necessary to properly care for the sewage of from 3,000 to 3,500 people during the summer. Also the use of the water for pumping causes an intermittent flow and for a considerable period of time

during the fall of 1908 no water was allowed to flow from the lake. This condition was obtained as the result of using for a time too much of the water for power purposes which lowered the lake considerably and by this period being followed by a season of very low runoff on the watershed.

General condition of lake and river

Conditions in lake near sewer overflow. At the overflow in the main sanitary sewer on the lake near the entrance to the Susquehanna river a small amount of sewage was overflowing into the lake during the greater part of the day. The point of discharge from this overflow is about 3 feet above the lake level. Below the discharge of the sewage on the shore of the lake considerable paper and fecal matter had lodged on the stones and was exposed to the air, forming a breeding place for flies and was in full view of persons passing through the park.

The lake water as it received the overflowing sewage became a dirty gray color which was very pronounced for about 100 feet from the outlet. Beyond this point the color or turbidity, due to the sewage, gradually became less at points further distant from the overflow until, at a distance of 500 or 600 feet, traces of the sewage could barely be seen.

The sewage overflowing into the lake is a potential source of danger to the village since the public water supply is taken from a point about 1,500 feet up the lake and the water is used without purification. A wind blowing up the lake might cause serious sickness in the village due to the contamination of the water from the sewage.

Also a part of the water intake pipe is laid upon the bed of the river from the lake to the pumping station and the pipe must necessarily be under a vacuum condition during pumping of the water. Therefore, any sewage overflowing into the lake or leaking from the main sewer, which is also laid in the bed of the river and which for part of the distance has a pressure from within greater than that from without, would mix with the river water and in the event of any open air valves or leaks in the water main the water of the village would be seriously contaminated. In the reconstruction of the intercepting sewer provision should be made in the location to keep the sewer at a sufficient distance from the river water, above the dam, and to have it of sufficient size to prevent the sewage from flowing under a head.

Condition of the river at the time of inspection. At the time of the inspection the temperature was about seventy degrees, the wind being from the west with a velocity of about three miles per hour, and the humidity was low.

The river below the water works pumping station flows through low land with fairly high banks and there are no houses near the river except at Susquehanna street where the nearest house is about 400 feet away. At places the banks have been used for dumping rubbish and present a very unsightly appearance.

The water company that furnishes the public water supply to the village was using steam power from 7 A. M. to 6 P. M. and water power from 6 P. M. to 7 A. M. to pump the water into the distributing system. The operation of the water power plant during the night resulted in an average flow in the river during the night time of about 62 cubic feet per second, but through the day when the water power plant was not in operation, this flow was reduced to about 1½ cubic feet per second. During the period of high flows the water power is used for twenty-four hours and during some of the dryest years no water is used for days at a time when the lake water is at its lowest point.

This condition of alternating between very little flow during the day and considerable flow at night produces a condition for about a mile below the water works similar to that which would result from the discharge of sewage into a large settling tank during the day which is flushed out every night with a larger flow. In this manner the sludge is deposited further down the river in the deeper portions. Dissolved oxygen was found to be present in all the samples tested, although the amount was found to be as low as 1.2 parts in the sample taken in the afternoon about 300 feet below the Susquehanna street outlet. The water in the river below the outlets appeared a little darker in the afternoon than in the morning. About one-half mile below the Susquehanna street outlet in a sluggish portion of the

river bubbles of gas could be seen rising, due to the putrefying action of the sludge lying on the bottom of the river. The discharge of sewage into the river at times when the water wheels are not in operation also results in a deposit of sludge in the bed of the river especially in the deeper places and places protected from the direct current. The bed of the river was covered with this sludge or sewage fungi growths and part of it was exposed during the day and gave off disagreeable odors. It was also stated by people who work near the river below Susquehanna street that at times there is a very strong odor of sour milk which was due to the wastes from the creamery.

A few very small fish were noticed in the stream near the sewer outlet at Susquehanna Street Bridge.

As the water wheels are started in the evening the water level in the river below the dam rises, causing the sewage from the main outlet to back up the river toward the dam resulting in very foul conditions in the section of the river extending 400 or 500 feet back to the dam. In the morning when the wheels are stopped the clearer portion of this sewage is gradually drawn off and part of the sludge which had settled is exposed during the day.

In order to determine the actual conditions of the sewage and of the river water above the sewer outlets analyses were made of the sewage and the river water above the outlets and of the river water at several places below the outlets. These analyses included the temperatures of the samples and tests for turbidity, oxygen consumed, dissolved oxygen, chlorine and putrescibility and the results are shown in the following table.

RESULTS OF ANALYSES OF SEWAGE, OF THE LAKE WATER AND OF THE RIVER WATER BELOW THE OUTLETS TAKEN ON AUGUST 25, 1914

LOCATION	Time taken	Temperature	PARTS PER MILLION					Putrescibility days
			Turbidity	Oxygen consumed 10 minutes boiling	Dissolved oxygen	Nitrates	Chlorine	
Lake ¼ mile west of outlet	9:30 a. m.	68°	Clear	3.3	4.8	Trace	3	20+
Sewage overflowing into Lake	10 a. m.	......	......	120	......	......	200	......
River below 1st outlet	10 a. m.	68°	17	32	3.2	......	25	2.1
River 300 ft. below Susquehanna Street	5:30 p. m.	......	......	32	1.2	......	50	2/3
River ¼ mile below Susquehanna Street	8:30 a. m.	64°	......	35	3.5	......	5	20+
River ¼ mile below Susquehanna Street	4:15 p. m.	......	......	15	5.25	......	7	20+
River ¼ mile above Phoenix Mills	3:00 p. m.	68°	Under 10	13.5	4.4	......	......	20+
River above dam at Phoenix Mills	2:50 p. m.	68°	Under 7	17	4.0	......	14	20+

While the results of but one set of analysis may not represent the average condition of the sewage and of the lake and river water, they do, nevertheless, show the condition at the time of inspection which may be stated as follows:

The lake water one-quarter mile west of the outlet was clear and non-putrescible. It had 3.3 parts of oxygen consumed, 4.8 parts of dissolved oxygen, a trace of nitrates and 3 parts of chlorine. These tests indicate a water at the point of sampling on the day of inspection apparently free from pollution.

The raw sewage as determined by the oxygen consumed test was about 20 per cent. stronger than the day flow of the average domestic sewage of a municipality of this size. The strength as shown by the chlorine test was

about 100 per cent stronger than the average domestic sewage. These high results are probably due to the wastes from the creamery.

The river water below the two principal outlets had 32 parts of oxygen consumed and in the chlorine test 25 to 50 parts were found. The turbidity of the stream had 17 parts as against the clear water of the lake. The river water below the upper outlet contained 3.2 parts of dissolved oxygen and the water below the second outlet in the afternoon had only 1.2 parts and plainly illustrates the reduction of dissolved oxygen due to bacterial action. The samples taken 300 feet below the second outlet were putrescible in two-thirds of a day and the sample taken below the first outlet was putrescible in 2.1 days. These tests show that if it were not for the night flush of clear water the river would be in a condition comparable to an open septic tank in one or two days.

The tests of the water in the river from one-half mile below Susquehanna street to the dam at Phoenix Mills showed the effect of the greater dilution of the day flow just below the outlets. The oxygen consumed gave about 15 parts except one test which gave 35 parts. The dissolved oxygen varied from 3.5 to 5.25 parts and compared favorably with the dissolved oxygen in the lake water. The chlorine varied from 5 parts to 14 parts as compared with the three parts contained in the lake water and indicated polluted water. The samples were not putrescible as the dilution was sufficient to care for the sewage during the night flow.

Summary and conclusions

As a result of this investigation and after a careful consideration of the conditions of the stream above and below the points of pollution and of the amount of flow to properly care for the quantity of sewage and other wastes discharging into the river the following summary and conclusions are presented:

1. That the sewage overflowing to the lake from the sanitary sewers causes a serious menace to the quality of the public water supply.
2. That the paper and fecal matter deposited on the shore of the lake at the overflow besides forming a breeding place for flies and constituting a menace to public health, renders conditions at this point very obnoxious and objectionable.
3. That the flow of the Susquehanna river at Cooperstown is not sufficient to afford adequate dilution for the quantity of sewage discharged from the sewer system of the village to prevent the creation of a nuisance during the summer season and at other times of low flow in the stream.
4. That any condition of nuisance is augmented by the intermittent operation of the water wheels since a greater part of the sewage remains in the river near the village during the day and at night the sewage and sludge are flushed down the river, and furthermore, that this sludge is again deposited in the more sluggish parts of the river as far as Phoenix Mills.
5. That there are occasional periods when water from the lake is not being used for power but is stored in the lake on account of drought and at such times putrefactive conditions are set up in the river below the dam and along the river for several miles below, thus affecting not only the village of Cooperstown but other municipalities situated below.
6. As a result, therefore, of the discharge of sewage from the village of Cooperstown into the lake a serious menace to the quality of the water supply furnished to the village is present at all times.
7. As a result of the discharge of untreated sewage from the village into the river; of the insufficient dilution of this sewage in the river; of the fluctuation of flow in the river; and of the fact that occasionally for several days at a time there is practically no flow in the river below the dam, a public nuisance is created in and along the river which affects not only the village of Cooperstown but other villages and riparian owners along the river below Cooperstown.

Recommendations

That in view of the above, I would recommend that the village of Cooperstown be required to construct, within a reasonable time, proper sewage disposal works to treat the sanitary sewage of the village, and that the village be requested to submit at an early date, for the approval of this Department, satisfactory plans for such sewage disposal works.

I would also recommend that the village authorities be required to submit as soon as possible, plans for that part of the sewer system which will prevent the overflow of any sewage into the lake or river above the dam, in order that this sewer may be constructed and in operation that temporary sterilization of all sewage overflowing into the lake be provided for.

I would further recommend that the attention of the village be called to the provision of Section 76-a of the Public Health Law and that they be advised that it is the intention of this Department to take action under said section, if, within a reasonable time, steps are not taken by the village to provide for proper treatment of the sewage now being discharged from the sewer system of the village into Otsego lake and Susquehanna river.

Respectfully submitted,

THEODORE HORTON,
Chief Engineer

ALBANY, N. Y., *June* 11, 1915

HAMBURG

HERMANN M. BIGGS, M.D., *State Commissioner of Health:*

An investigation of sewage conditions in the incorporated village of Hamburg, Erie county, with especial reference to pollution of Eighteen Mile creek was made on October 4, 1915, by Mr. C. A. Howland, inspecting engineer, following the receipt of a number of complaints from residents of the town of Hamburg.

The records of this Department show that complaints have been received by this Department in regard to insanitary conditions and public nuisances arising from the lack of proper sewerage and sewage disposal in the village of Hamburg for a number of years. In 1908 a complaint signed by eighteen residents of the town of Hamburg was received and this complaint stated that a nuisance was created by the discharge of sewage from the village of Hamburg into a small brook which flowed for three miles before discharging into Eighteen Mile creek.

On September 10, 1908, plans for sewerage and sewage disposal for the village of Hamburg were approved by this Department but it appears that the proposition to construct sewers was defeated at a subsequent election. Further complaints were received in 1909, and in June, 1910, a second application was made for the approval of plans for a combined sewer, a similar application having been denied in June, 1909. The present complaint has reference to a small ditch or stream which flows through farm lands for about three miles before discharging into Eighteen Mile creek.

The village of Hamburg is situated in the southeastern part of the town of Hamburg, Erie county, about eight miles south of the city of Buffalo. The population according to the census of 1910 was 2,134, and a comparison of the figures for previous years shows that the village has undergone a continuous steady growth. The present population of the village is estimated at about 2,000.

The village is supplied with a public water supply taken from wells situated about one and one-half miles southeast of the village and from a well situated in the northern part of the village. The engineer learned from Mr. N. C. Fish, secretary and treasurer of the Hamburg Water and Electric Light Company, that there are some 650 consumers of whom all have meters. However, the exact water consumption per day is apparently not known, but

it was estimated to be about 100,000 gallons, of the 650 consumers it was estimated that about 80 per cent. have installed flush closets.

The engineer conferred with Mr. Jacob E. Leach, village president, with Dr. Lee Gunn, acting health officer and with Mr. George W. Nichols, C. E., village engineer. From these gentlemen it was learned that there has been constructed in the village of Hamburg several miles of sewers. These sewers at present discharge into Eighteen Mile creek through three outlets and into a small stream near the Erie station. The sewers are all combined sewers and the engineer was informed that those houses which have modern sanitary plumbing are required to install septic tanks or double cesspools through which the sewage must be passed before it discharges into a village sewer. One of the cesspools is constructed of brick with tight walls, while the other is a leaching cesspool.

The engineer visited the outlets of these sewers and found that in every case sanitary sewage was being discharged through them and from the character of the sewage it was apparent that all of the sewage had not been first passed through either septic tanks or cesspools. The so-called Pine street sewer discharges at the end of the retaining wall on East Main street. The sewage issues from a 12-inch outlet and flows down a short ravine to Eighteen Mile creek. There could be no doubt from the odor and character of the sewage that it contained fecal wastes. About 100 people are said to be connected with this sewer. The East Main street sewer which it was said receives the sewage from about 200 people discharges into a ravine in the rear of the Judd Rogers property. The sewage flows through the ravine into Eighteen Mile creek. The clarified and dark appearance of this sewage at the time of the inspection would indicate that it is first passed through settling tanks.

The Lake street sewer, with which about 300 people are said to be connected discharges sanitary sewage from a 10-inch cast iron pipe near the edge of a steep bank of Eighteen Mile creek about opposite the foot of Lake avenue. About 1,000 people are said to be connected with the Pleasant avenue sewer which discharges on the east side of the Erie railroad right of way near the depot. A considerable flow of sanitary sewage, containing toilet paper is discharged from this sewer into a pool formed by a low brick dam in which is provided a spillway. An intake pipe controlled by a valve draws from this pool for a water tank of the Erie railroad. The excess flows easterly through properties of Mr. Fattey and others for a distance of about three miles to Eighteen Mile creek. The engineer conferred with Mr. Fattey and with a number of persons who have property through which the stream passes and was informed that the odor arising from the discharges are obnoxious at their homes; that the quality of the water is injured for watering cattle and that the flow in the stream is increased to such an extent in times of rain as to flood the adjoining property. The slope of this stream is very flat, being about 5 feet per mile and it is apparent that sedimentation will occur and putrefaction result from the discharge of sewage into it.

At the time of the inspection about 1,300 feet of sewer ranging in size from 10 to 12 inches were being laid in Pine street. This sewer is to discharge into Eighteen Mile creek at a point about midway between Lake avenue and Center street. About 260 feet of the 10-inch sewer is to be laid on a slope of 6 per cent. and about 1,280 feet are to be laid on a slope of .03 per cent. It was stated that manholes are to be placed in this sewer at a distance of about 500 feet apart. The engineer observed that apparently few manholes had been constructed in the other sewers and he was informed that when the sewers become clogged they must be taken up in order to remove the obstructions. Such taking up of the sewers has become necessary in the village a number of times; at least twice during the last four years. The catch basins are connected directly with the sewers and Mr. Nichols informed the engineer that those which he has constructed are built of plank 2 feet by 2 feet in plan. Storm water enters from openings in the top and flows into a gutter 1 foot by 2 feet in plan and 1 foot deep located under the opening at the top of the catch basin. This gutter overflows into the bottom of the catch basins and the outlet is located about 1 foot above the bottom.

From the above inspection it appears that although a number of sewers have been built in the village of Hamburg these sewers are improperly constructed and discharge in such a manner as to endanger the health of the people and to give rise to a public nuisance. The improper construction of sewers is shown by the fact that they are not provided with manholes so that they may be readily cleansed and a section of the sewer must be taken up at considerable expense when it becomes clogged. That such clogging occurs indicates that the sewers are not laid on slopes sufficiently steep to provide self-cleansing velocities. It also appears that it has been necessary to take up and replace sewers which have become too small to carry the volume of sewage contributed to them. The discharge of sanitary sewage through these sewers which have not been approved by the State Commissioner of Health is in violation of the provisions of the Public Health Law and the village or the parties responsible for such discharge are subject to the penalties stated in the Public Health Law.

About 80 per cent. of the houses in the village are at present provided with modern plumbing facilities and it is to be expected that with the increase in the proportion of the houses which will contribute sewage to the sewers and also because of the growth of the village, the volume of sewage will continually increase. The present method of constructing sewers is obviously uneconomical for the following reasons: First, proper facilities for cleaning the sewers are not provided and they therefore have to be taken up and replaced at considerable expense; second, slopes too flat to provide self-cleansing velocities are apparently provided in some of the sewers; third, the expense of replacing sewers which are too small can be avoided by building the sewers large enough in the first instance; fourth, the expense of constructing either septic tanks or double cesspools becomes unnecessary as soon as a properly designed and constructed system of sewerage and sewage disposal is built. These unnecessary expenses can be avoided by constructing properly designed sanitary sewers and a sewage disposal plant.

It is proposed by the village to intercept the sewage which discharges through the Pleasant avenue outlet and convey it to Eighteen Mile creek. The engineer called the attention of Mr. Nichols to the fact that such sewer construction without the permission of the State Commissioner of Health is in violation of the Public Health Law. It is apparent that the village of Hamburg from the standpoint of health, economy and comfort should take steps at once to provide itself with a permanent and adequate system of sewers to care for the immediate and future growth in population and to permanently abate the conditions of nuisance. This does not necessarily mean that the sewers at present need be entirely abandoned but where they are found to be large enough and have sufficient grade they may be incorporated in the more comprehensive system or used as storm sewers alone.

I therefore beg to recommend that the authorities of the village of Hamburg be advised to take steps at once to construct sanitary sewers in accordance with the plans approved by this Department. Such steps must ultimately be taken by the village and it is imperative that this action be taken at once in order to avoid the unnecessary expense of building septic tanks, cesspools and sewers which are inadequate. Furthermore, under the present status of sewer construction in Hamburg, the definite provisions of the Public Health Law are being grossly violated and it is imperative that action be taken by the village authorities to bring the matter of sewerage in the village within the law.

I would, therefore, also recommend, as an essential step the placing of the sewerage of the village on a proper basis that the trustees of the village be advised to arrange at once for the preparation of a revised general plan for sewerage and sewage disposal for the village embodying as many of the sewers now constructed as possible and the submission of such plans for the approval of this Department as required by the Village and Public Health Law.

Respectfully submitted,

THEODORE HORTON,
Chief Engineer

ALBANY, N. Y., *October* 14, 1915

MARION (town)

HERMANN M. BIGGS, M.D., *State Commissioner of Health:*

An investigation of the pollution of a tributary of Red Creek by wastes from canning factories and from sewage in the unincorporated village of Marion, town of Marion, Wayne county, was made on Oct. 5, 1915, by Mr. C. A. Howland, inspecting engineer, in company with Dr. A. Besemer, health officer of the town of Marion and Dr. W. H. Hennessy, health officer of the town of Palmyra.

The records of this Department show that a permit allowing the discharge of waste water and washings from the J. B. Malcolm and Company cannery at Marion into the waters of Marion creek was issued by this Department on August 8, 1907. A permit allowing the discharge of effluent from a settling tank to treat the waste water and washings from the Wayne County Canning Company cannery into Marion creek was issued on August 31, 1911, subsequent to an investigation made by a representative of this Department. On July 17, 1914, plans for a disposal plant to treat the sanitary sewage from the factory of the Wayne County Canning Co. were approved. The present investigation was made at the request of Dr. Besemer, the local health officer and of Dr. Hennessy, health officer of the town of Palmyra to whom a complaint had been made by a farmer residing near East Palmyra.

The unincorporated village of Marion, which has a population of about 800, has a public water supply and it was estimated that about 37 per cent. of the houses are connected with the water system and about 5 per cent. of the houses have flush closets. The sewage, the engineer was informed, is disposed of principally by discharging it into septic tanks, the overflow from which passes into sewers, emptying into tributaries of Red Creek.

One of these sewers, which, it was stated, receives sewage from about 6 houses, including closets, baths, sinks, etc., and storm waters from the street discharges into a small ditch near the Wayne County Canning Co. plant. A second sewer, said to receive the overflow from improperly constructed septic tanks and sewage from sinks, closets, etc., of about 20 houses, discharges into a ditch near the vinegar factory. The ditch has little slope and as the flow is retarded by vegetation, it is stated that the odor arising from the putrefying sewage becomes obnoxious. Just below a bridge over the stream at Palmyra street, a 6-inch sewer discharges into the creek.

The engineer inspected the banks of the stream and found that privies are located near and in some cases over the stream and drains from houses discharge into it. Rubbish of different kinds, including garbage is thrown upon its banks. Probably the largest accumulation of refuse had been thrown, on a flat area bordering the stream below Mill street, by the J. B. Malcolm Canning Company. This refuse consists of parings, etc., from the canning processes.

Inspections were also made of the two canning factories. At the Wayne County Canning Company plant it was found that a rotation of fruits and vegetables are canned, about 70 persons being employed in the canning season and about 10 at other times. Mr. C. N. Jager of Marion is president of the company and Mr. C. H. Scutt is manager. The volume of water used per day, computed from data furnished the engineer, amounts to a total of about 10,000 gallons per working day.

The sanitary sewage from flush closets, etc., is discharged into a settling tank about 18 feet by 10 feet in plan and 6 feet deep, the effluent from which is discharged into a subsurface irrigation system. The engineer was informed that the company has had no trouble with the system, one-half of which alone has been used.

The wastes from the canning processes vary with the fruit or vegetable being canned and consist of blanch water, wash water from vegetables and wash water from floors and machines. The wastes are collected by gutters in the concrete floor and discharged through a 10-inch concrete and tile sewer into a series of three settling basins consisting of excavations in the city soil in a flat area near the buildings. At the time of the inspection these

basins were filled with wastes, which were advanced in putrefaction as indicated by the bubbles of gas and marked odor. The basins which are said to be cleaned every spring, have a total capacity considerably greater than one day's flow of the wastes. The effluent discharges into a small ditch or stream. The solid wastes from the cannery, such as parings, pea pods, etc., are disposed of on a farm removed from the village.

The engineer also visited the J. B. Malcolm and Co. cannery which is also in the village of Marion and which was built in 1913, to replace one destroyed by fire. About 150 people are employed at this cannery during the canning season and only two or three at other times. A rotation of fruits and vegetables are canned. The volume of water used, computed from data furnished the engineer appears to be about 8,000 gallons per day from the village supply and about 30,000 gallons pumped, making a total of about 38,000 gallons per day. The wastes are similar to those from Wayne County Canning Co. plant described above.

Six flush closets are installed in the buildings and the sanitary sewage is discharged into settling tanks which are completely covered by earth. The dimensions of the first tank were given as 24 feet by 8 feet by 5 feet and it is said to be fitted with brick walls through which the sewage filters and the walls have screens on top. The sewage, it is said also passes into a second tank, the dimensions of which were given as 10 feet by 12 feet by 5 feet and the effluent discharges into the stream. This disposal plant was built about five years ago.

The wastes from the processes of canning vary in character with the fruit or vegetable which is being canned. The blanch water falls on the ground through openings in the floor of the shed in which this process is carried on and drains into the creek. The wash water from floors and machines discharges into the creek without treatment and the cooler water discharges on the cellar floor and passes into the creek through a drain.

At the time of the inspection the conditions produced in the stream could not be called obnoxious, probably because of the considerable flow of water but at the junction of the stream into which the wastes discharge, with the main stream, a marked difference in the turbidity was noticed, the waters of the polluted stream being much darker in character.

In the course of the investigation the engineer talked with Mr. A. H. Feller of East Palmyra, who claimed that the pollutions of Red Creek from the wastes and sewage at Marion has also given rise to obnoxious odors. Mr. Feller owns a farm located about 4½ miles down Red creek from Marion, and ships milk to Rochester. The creek flows through a farming county between Marion and East Palmyra, where cattle have access to the water.

From the above inspection it appears that the pollution which enters the tributary of Red creek at Marion may be divided into three groups namely: wastes from canneries, sewage and storm water from the sewers and drains of Marion, and refuse and fecal matter deposited on or near the banks of the stream.

The sanitary sewage of both canneries is treated in disposal plants, and at the Wayne County Canning Co. plant the canning wastes are treated by sedimentation in three basins, which although crude in design and construction, probably retain a considerable portion of the solids in the wastes. At the J. B. Malcolm & Co. plant, the wastes from the processes of canning are not treated in any way before being discharged into the stream and it is apparent that these wastes containing as they do considerable quantities of putrescible organic matter, will putrefy in the stream and give rise to obnoxious conditions, especially at times when the flow in the stream is low.

I, therefore, beg to recommend:

1. That the J. B. Malcolm Canning Company be advised to take up at once the matter of building a disposal plant to treat the wastes from their cannery before their discharge into the stream.

2. That the Wayne County Canning Company be advised to take up at once the matter of improving the disposal plant to treat the wastes from their plant such as by the installation of a properly designed and constructed two-compartment tank provided with means for easy removal and treatment of the sludge.

In regard to the second source of pollution of the stream, namely, sewage from the sewers in the village of Marion, the most satisfactory and permanent method of disposing of this sewage is for the village to build properly designed sewers for this purpose. As a public water supply is available in the village it is to be expected that the number of houses in which modern sanitary plumbing is installed will increase, causing a corresponding increase in the volume of sewage to be taken care of. The installation of properly designed sewers will provide for this future increase in the volume of sewage and give a permanent means of caring for all the sewage. The expense of constructing cesspools or septic tanks and sewers to care for the overflow or of providing private sewers might better be applied to annual payments on a long term bond issue to build adequate sewers. By such a method a permanent benefit is obtained for the village whereas the sewers, drains and cesspools built by the individual method frequently have to be taken up and replaced because of inadequate size or wrong construction.

I, therefore, beg to recommend that the residents of the village of Marion be advised to proceed under the provisions of the Town Law and Public Health Law to form a sewer district and employ a competent engineer to design a system of sewers and sewage disposal works for the district, the plans to be submitted to this Department for approval as required by law.

In regard to the depositing of refuse on or near the banks of the stream or in such other locations in the town that obnoxious conditions are produced such matters are entirely within the jurisdiction of the local Board of Health and should be regulated by the enactment and enforcement of proper regulations.

Respectfully submitted,

THEODORE HORTON,

Chief Engineer

Albany, N. Y., *October* 5, 1915

OGDENSBURG

Memorandum of Mr. Holmquist regarding inspection of the outlet of the proposed William street sewer with special reference to the probable effects of the construction of this sewer on the bathing beach below William street.

The inspection was made by Mr. Holmquist in company with George A. Tate, city engineer of Ogdensburg. Mr. Julian Frank, mayor of the city, Mr. John Burke, owner of the bathing beach and Miss Mary K. Hasbrouk, disinterested owner of property near the bathing beach, were interviewed after the inspection. All of these people agreed on the desirability of protecting the bathing beach from gross pollution as it is practically the only available beach suitable for bathing in the city.

William street is located about 1,400 feet west of the city line and about 500 feet above the bathing beach owned by Mr. Burke. The river at this point forms a cove and is very shallow for 300 or 400 feet from the shore. The banks of the river, except in the vicinity of William street, are abrupt and drop almost vertically about 20 feet to the water's edge. The slope of the bank at William street is less steep than the slope of the bank either above or below this street. Back from the top of the bank of the river the land is nearly flat, having but a slight slope in a southerly direction away from the river. Proctor avenue has a slight slope east and west toward William street.

There is at present a 12-inch storm sewer which serves William street and a portion of Proctor avenue and discharges on the bank of the river about 10 feet from the water's edge. Although the city engineer stated that as far as he knew this sewer was used for storm water purposes only as no permits had been issued by the city for house connections with the sewer, the discharge from the sewer, however, was slightly turbid and although there was no evidence of discharge of flush closets into the sewer it is probable that sink wastes and overflow from cesspools reaches this sewer.

There are three alternative methods of caring for the sewage in William street and Proctor avenue and vicinity and discharging it into the river in such a manner as to give reasonable protection to the bathing beach, namely:

1. By carrying the outlet some 500 feet from the shore into deep water at a point beyond the shallow section of the river.
2. By passing the sewage through a settling tank at the foot of William street.
3. By discharging the sewage into the river at the point of land below the northerly end of the bathing beach.

The first plan and the one favored by the city engineer would prevent floating material from reaching the shore of the bathing beach except perhaps during a strong northwest wind, when some of the sewage might reach the beach. Although the depth of the river opposite William street some 500 or 600 feet from the shore is said to be only about 7 or 8 feet it was stated by the city engineer that the current is fairly swift at this point and that in his opinion no pollution would reach the bathing beach from an outlet at that point.

With respect to subjecting the sewage to partial treatment before discharging it into the river it was found that there is ample space for a settling tank and sludge bed near the foot of William street and that this section is at present sparsely settled, there being only two houses within 300 feet of this point. The objection to this plan, however, would be that it might not form adequate protection for the beach and that it might be a source of nuisance should the section in the vicinity of William street be developed in the future, which is quite probable.

The last alternative of discharging sewage into the river near the city line below the bathing beach appears to be the most practicable. The sewer in Proctor avenue could be carried easterly to Dearborn street or to the city line and thence along the city line to the river without excessively deep cutting. This would not require much deeper cutting than if the sewer were constructed in William street. The water at the point of land below the bathing beach is deep and the current of the river swift so that it would not be necessary to carry a sewer more than 100 feet from shore and there would be no probability of pollution reaching the bathing beach if sewage should be discharged at this point. It was learned from Mr. Burke, the owner of the land through which the lower section of the sewer would be constructed, that he would give the city a right of way through his property without any expense to the city.

In carrying out any of the above plans the sewage should be kept separate from the storm water inasmuch as this is a new section not provided with sewers and since in all probability treatment of sewage of the city will be required sometime in the future. The storm water from William street and vicinity could be discharged into the river at the foot of William street without objection. This matter was discussed fully with the city engineer and the mayor and they appeared to appreciate the desirability of providing for a separation of the sewage in this newly developed section of the city.

ALBANY, N. Y., *September* 23, 1915

PORT WASHINGTON

Memorandum regarding Port Washington sewerage

Mr. Cleveland visited Port Washington according to a previous arrangement on September 24 and conferred with Mr. Suter of the Conservation Commission and with the board of sewer commissioners and the engineer for the Port Washington sewer district regarding the tentative plans for treatment of the sewage and the location of the disposal plant. A letter was exhibited which had been received by the sewer commissioners from the Conservation Commission in which it was stated that under the classification of the waters laid down by the State Department of Health the Conservation Commission would undoubtedly approve the plans for sewage disposal

if sedimentation only were provided for, but Mr. Suter agreed with Mr. Cleveland in his statement that both the Health Department and the Conservation Commission in finally passing upon plans would probably require sterilization of the effluent from a settling tank at present with stipulation for future treatment in filters if found necessary in the future. The engineer for the Commission, Mr. Carl H. Watson, explained that the Commission desired to improve some of the bay front extending northeasterly from the public dock by building a bulkhead from the public dock a distance of approximately ¼ of a mile easterly and filling in to the extent of 8 or 9 acres, thus extending the present flat in the developed portion of the bay front which now comprises 3½ acres and allowing the Imhoff tanks and sterilization works in the park system to be developed on this reclaimed land. It was proposed to carry the sterilized effluent from the Imhoff tank out into the main channel of an arm of the bay northwesterly from the Port Washington docks.

Mr. Cleveland and Mr. Suter advised the board that in their opinion favorable consideration would be given to the treatment of sewage in the manner and at the site proposed.

ALBANY, N. Y., *October* 1, 1915

WALTON

HERMANN M. BIGGS, M.D., *State Commissioner of Health:*

An investigation of the sewerage conditions in the village of Walton was made on September 21, 1915, by Mr. C. M. Baker, assistant engineer, accompanied by Dr. C. C. Duryee, sanitary supervisor of District "C," and Dr. E. Alexander Hand, health officer of the village of Walton.

This investigation and report were made because of the insanitary conditions which are known to exist in this village regarding sewerage and sewage disposal. Although the question of sewerage has been considered to some extent by the village authorities, it is apparent that little or no progress has been made within the last year or so regarding this matter which so vitally affects the health of a community.

Walton is an incorporated village located in the town of the same name, Delaware county, on the Ontario and Western R. R. about 30 miles southeast of Sidney. It is on the west branch of the Delaware river and three streams, East brook, West brook and Third brook flow through the village and discharge into the river within its limits. It is the center of a prosperous dairying district and is one of the most important towns in Delaware county. The population of the village in 1900 was 2,811; 1902, 2,861; 1905, 2,911; 1910, 3,103; and it is now estimated at 4,350, thus indicating a substantial and continuous growth.

A water supply was installed in the village by a private corporation in 1878 and as a result of this plumbing has now been installed in the majority of the houses. In view of the lack of municipal or other adequate sewerage in the village the sewage from the houses is usually disposed of in the most convenient manner, which results in many unsatisfactory and insanitary conditions throughout the village.

The question of sewerage for Walton was first taken up in 1889 when an investigation of the village was made by Mr. Charles C. Brown, consulting engineer to the Department, who submitted a report on the conditions then existing to the State Board of Health. (See page 136, 10th Annual Report.) This report discussed to a considerable extent the insanitary conditions then existing in the village because of the lack of sewerage and also pointed out the necessity of constructing an adequate system of sewers providing proper sanitary conditions were to be maintained in the village. As a result of the above investigation plans for a system of sewers for the village were submitted and approved by the board of health the following year, 1890. (Page 355, 11th Annual Report.) These plans, however, were never carried out.

The insanitary conditions regarding sewerage in Walton were again brought to the attention of the Department in 1913 at which time it was

pointed out to the village authorities that this matter had been before the people of the village as long as twenty years ago; that insanitary conditions existed in the village due to inadequate sewerage; and that the board should proceed without delay in placing the matter of providing a sanitary system of sewers and sewage disposal before the people for a vote.

In 1914 revised plans for a sewer system and sewage disposal were partly prepared. No plans, however, have recently been submitted to this Department for approval and it appears, therefore, that nothing has been done during the last year to complete and carry out the proposed plans for providing sewerage for the village of Walton.

Although as stated above there is no municipal or other adequate sewerage system in Walton, there are several private systems which discharge sewage without treatment into the river and creeks at various places within the village. The principal of these are as follows:

1. A sewer system from the James Munson Extension collects and discharges sewage from approximately 50 houses or 250 people into the stream without treatment.
2. A private system collects sewage from the business section of the village which includes probably 100 to 150 people and discharges without treatment into the river.
3. The Walton Toy and Metal Company, at which place are employed from 100 to 150 persons, discharges sewage without treatment into the river.

The sewage from all the above systems is discharged into the river within the village and at places in close proximity to buildings. The sewage from the business section is discharged near the bridge crossing the Delaware river.

In addition to the above systems, which include only the larger and more permanent ones, there are numerous other smaller systems discharging into the creeks and rivers, each of which receives the sewage from one to four or five houses. There are probably between forty or fifty such systems and in many cases these sewers discharge on the banks of the stream and not directly into the river. This condition was particularly noticed on Park street where the sewage from some five or six houses is conducted across the street by sewers which discharge on the bank of East brook.

Including all of the private sewer systems of the village it is estimated that the sewage from 1,000 to 1,200 people is discharged without treatment directly into the river and creek within the village and it is apparent that in many cases these sewers are improperly constructed and instead of discharging directly into the water discharge on the banks of the stream, thus allowing the sewage to accumulate in exposed places to a considerable extent.

The sewage from the remainder of the village where plumbing fixtures are provided is cared for by cesspools. It is necessary to abandon the old cesspools and construct new ones occasionally and the assistant engineer was informed that in some cases it has been difficult to find a suitable place in the yard in which to construct them. These cesspools cause pollution of the ground water and soil in their vicinity. Furthermore, due to the accumulation of sludge the soil eventually becomes so clogged as to cause them to overflow, thus resulting in insanitary conditions in the vicinity. These conditions have been repeatedly pointed out to the village authorities by the Department and as previously stated were, as far back as 1889, discussed in Mr. Brown's report. It is obvious that the conditions are continuously becoming worse due to the increased population and accumulation of pollution.

A considerable portion of the village is still provided with privies. It was apparent from the inspection, however, that these privies are generally maintained in a satisfactory condition which, however, is undoubtedly due to the vigilance of the health officer. Nevertheless, any type of privy located within a village is apt to cause insanitary conditions if neglected and may thus become a menace to the health of those in the vicinity and, undoubtedly, these conditions occur notwithstanding the activities of the health officer.

As a result of this investigation I would draw the following conclusions:

1. That the sewage from 1,000 to 1,200 people is discharged into the stream within the village of Walton without treatment and that in

many cases this sewage is discharged on the banks of streams and not directly into the water.

2. That the sewage from toilets in a large portion of the village is disposed of in cesspools which cause pollution of the ground water and soil in their vicinity, and at times insanitary conditions and a menace to health.

It is obvious that with the methods of sewage disposal now employed in the village there is always a danger of a spread of infectious diseases through the agency of flies and other sources of transmission. This is especially true where sewage is allowed to discharge on the surface of the soil and where privies are not maintained in a sanitary condition. Furthermore, it is evident that these conditions must at certain seasons of the year cause very disagreeable odors in certain sections of the village and in many cases undoubtedly constitute nuisances.

In view of the above it is evident that the village of Walton should provide adequate sewerage if proper sanitary conditions are to be maintained and the health of the inhabitants conserved. I therefore beg to offer the following recommendations to be acted upon by the village authorities:

1. That the plans for a complete sewer system and sewage disposal plant be completed and submitted to this Department for approval as required by law.

2. That when these plans have been submitted to this Department and approved the village take steps immediately to carry them out and construct the system as soon as practicable.

3. That when the system is completed the private sewers, cesspools and privies within the village be abandoned and all houses required to connect with the public sewers.

While under the Village Law it is necessary and this Department must require the submission of complete plans for sewerage and sewage disposal covering all portions of the village, it does not necessarily mean that the complete system must be constructed at once for application may be made in accordance with the Village Law to omit certain less necessary portions. By issuing a series of long term bonds the cost of the construction may be reduced to a yearly figure which will not greatly exceed and may even be less than the present amounts expended by the village and by individuals in the construction of new cesspools, cleaning privies, etc. In any event an adequate sewerage system could undoubtedly be constructed without causing a burden upon the village.

Respectfully submitted,

THEODORE HORTON,

Chief Engineer

ALBANY, N. Y., *October* 27, 1915

In addition to the foregoing inspections were made on advice given through correspondence in matters relating to sewerage and sewage disposal at the following places:

Catskill.
Clay (town).
Forestville.
Greenwich.
Lebanon (industrial school).
Liberty (Workmen's Circle Sanatorium).
Long Beach.
Massena.
New City (County Court House).
New Windsor.
Niagara Falls.
Oak Island.
Plandome.
Schenectady.
Troy.
Watertown.

PROTECTION OF PUBLIC WATER SUPPLIES

INVESTIGATIONS OF PUBLIC WATER SUPPLIES

Approximately 420 public water supplies in the State are not protected by Rules and Regulations enacted by this Department. Many of these supplies, however, have been voluntarily investigated and reported upon by this Department through its Engineering Division. In view of the great importance of having available full information relative to the supplies concerning which the Department had little or no information, it was decided in the middle of the year to concentrate a large share of the efforts of the Engineering Division upon investigations of these supplies. Two assistant engineers engaged in other special work were assigned to investigate and report upon water supplies in addition to the assistant engineer regularly assigned to this work. Furthermore, part of the supplies which had been investigated by this Department prior to 1913 were reinspected by sanitary supervisors and the supplementary data obtained by them submitted to the Engineering Division for the preparation of reports. As a result of this concentration of effort, some 217 investigations of public water supplies were made and of these some 167 were reported upon in detail, the reports upon the remainder being in the process of completion at the end of the year.

As in the past, these investigations have involved in the majority of cases, careful field inspection and collection of samples of water for analysis and preparation of reports which embody the results of such investigations together with conclusions and recommendations for improvements. Such reports have been transmitted to the local authorities and marked improvements have been brought about in many instances as a result of these investigations.

ALBION

HERMANN M. BIGGS, M.D., *State Commissioner of Health:*

An investigation of the public water supply of Albion, Orleans county, was made on May 11, 1915, by Mr. E. S. Chase, assistant engineer, following the receipt of a request from the village authorities for such an investigation. The assistant engineer was accompanied and aided on the inspection by Mr. Schuyler Hazard, president of the village, and Mr. Eugene Mahoney, superintendent of water works.

Albion is an incorporated village with a population of about 5,200 located 30 miles northwest of Rochester on the Niagara Falls branch of the New York Central R. R. and also on the Buffalo, Lockport & Rochester Electric

R. R. The Erie canal passes through the village. This village is in the center of an extensive agricultural region and in its vicinity are located large quarries of Medina sand stone. The village is served by a system of public sewers recently completed.

The public water supply of Albion is derived from two sources, the original source being wells located northwest of the village just outside the village limits, the second source being Otter creek. The waterworks system was designed and constructed by Bassett Bros. of Buffalo about the year 1890 and, until the first of the present year, was owned and operated by the Albion Water Works Company. Since then, however, the water works have been owned and operated by the village under the jurisdiction of the Board of Trustees.

The Otter creek supply is developed by damming the stream two miles west of the village and pumping the water from the reservoir thus formed to collecting basins at the main pumping station in the northwestern part of the village. From the pumping station, the mixed water from both sources is pumped through the distribution system against pressure maintained by a standpipe in the southern part of the village. It is estimated that the average daily consumption is 325,000 gallons serving about 4,000 people or 80 per cent. of the population. There are in all ten miles of water mains ranging in size from four to ten inches in diameter and five additional miles of water mains are to be laid this summer. There are 1,100 service taps of which about 40 per cent. are metered, although it is planned to meter all the services in the future. The average water pressure in the water mains is about 65 pounds per square inch. The standpipe is of steel, 25 feet in diameter and 75 feet high and with a capacity of 275,000 gallons.

In order to obtain a supplementary supply for fire protection, an intake pipe was extended by the water company in earlier years to the Erie canal and a siphon was also constructed so that canal water might be delivered into the reservoir at Otter creek. The village, however, is planning to abandon these auxiliary intakes as soon as improvements can be made to the present system, which will insure an adequate supply of water of satisfactory quality.

There are 14 drilled wells at the pumping station, but of these only 8 are in service at present. The majority of these wells are about 45 feet in depth although there is one which is 85 feet. All but 3 or 4 are 6 inches in diameter and these exceptions are about 2 inches in diameter. There is little information available as to the character of the soil through which these wells were driven. It is said, however, that the material is gravel. The Erie canal is about 300 feet south of the wells at a somewhat greater elevation than the ground in the vicinity. It is thought that there is very little infiltration from the canal as it is claimed that there is an impervious layer between the bottom of the canal and the water-bearing strata. A few feet north of the wells there is a small surface stream which can be diverted into a depression near the wells. It is stated that surface water collected in this depression slowly reaches the wells by infiltration. This surface water receives wash from a considerable area devoted to agriculture but is not otherwise grossly polluted. About 100 feet northwest of the wells is a shallow dug well about 15 feet in diameter. At the time of the inspection, the elevation of the ground water in this well was about 3 or 4 feet below the surface of the ground and it would therefore appear that the water of this shallow well is not affected by the draft upon the deeper wells.

The pumping station consists of a substantial brick structure 34 by 64 feet in plan, one end of which is two stories and contains the living quarters of the engineer. There are two Buffalo horizontal duplex steam pumps and one electrically operated duplex Fairbanks pump. One of the steam pumps is out of commission and the other used only for emergency. Under ordinary conditions all the pumping is done by the electric pump.

At the Otter Creek reservoir there is a directly connected electrically driven No. 3 Gould centrifugal pump housed in a small stone building. The Otter creek water is pumped from the reservoir through about two miles of pipe

into a two-compartment concrete basin at the main pumping station. This basin is about 65 x 100 feet in plan and 8 feet deep, divided longitudinally into two parts; the first compartment was originally designed as a filter. This portion contains two layers of brick on edge forming underdrains and then about six inches of gravel and one inch of sand. Formerly there was six inches of sand, but at times of cleaning, the sand has been removed and not replaced. The Otter creek water after passing through this filter flows into the second compartment or so-called clear water basin and from thence is pumped, together with the water from the wells, to the village. Pumping from Otter creek averages about 15 or 16 hours a day and pumping to the village amounts to approximately 17 hours a day.

Conditions at the main pumping house surrounding the wells and creek water receiving basin are not particularly satisfactory. The receiving basin is uncovered and its sides are flush with the surface of the ground and, at times of rainfall, a small amount of surface wash must reach this basin. About 30 feet from the basin in one corner of the coal shed is a privy. The ground between the basin and the privy is practically level. The engineer of the pumping station keeps a number of chickens, which are allowed to run over the entire property and which probably cause some contamination of the water in the basin. The sink drains from the residence of the engineer discharges into the depression near the wells referred to previously. While these conditions may not be a serious menace to the sanitary quality of the supply, they are decidedly objectionable from an esthetic standpoint and can be easily remedied.

The Otter creek reservoir is formed by a masonry dam just south of the point where the creek flows under the Erie canal. This dam is about 12 feet high and forms a reservoir about one-third of a mile long and 200 feet at its widest part with a surface area, when full, of 370,000 square feet and a capacity of 14,600,000 gallons. This reservoir is crossed by a highway about one-third the length of the reservoir from the dam. It is at this point that the pumping station is located. The intake is 18 feet from shore and consists of a well about 18 feet deep into which the suction line from the pump extends.

The watershed area of Otter creek is approximately 16 square miles. This area is comparatively level or gently rolling and occupied mainly by farms. The soil is a mixture of sand, gravel, and clay overlying Medina sandstone, and limestone. Practically the entire area is cleared land and very little is wooded. At the head of the stream is quite an extensive swamp area. During the greater part of the year, the runoff from this watershed is much more than adequate for the needs of the village, but during the dry months of July and August, there is very little flow in the creek.

There are 150 houses on the watershed with accompanying barns and outbuildings and the total population may be estimated at 750 or 47 per square mile. The great majority of these houses are well distant from the stream and, on account of the gradual slopes, there is probably little direct contamination. In one or two instances, however, barns are located comparatively close to the stream and there is considerable opportunity for pollution by surface wash from cultivated land and pastures. At the Eagle Harbor station of the N. Y. C. R. R., there is a storehouse located over the stream. There is also at this point a house on a bank of the creek at which the privy is located directly on the bank, this privy being the most serious case of pollution existing on the watershed. About one-half mile south of the Eagle Harbor station is a large quarry located near the stream. This quarry employs about 85 men. The sanitary conveniences for these men are located several hundred feet from the stream.

No cases of typhoid have been known to occur on the watershed nor have there been any epidemics of typhoid fever in Albion. There is no sanitary control of the watershed nor have rules and regulations been enacted by this department. Fishing in the reservoir is not prevented and ice cutting occurs during the winter.

The Erie Canal water which may be used in case of emergency is seriously contaminated by the sewage discharged from numerous municipalities located

west of Albion and the dangerous character of water from the canal is too well known to require extended discussion. The village authorities appreciate the undesirability of ever using this supply and have under consideration such improvements to the present supply, or the obtaining of an additional supply, which will insure at all times a supply both adequate in quantity and satisfactory in quality.

About two miles south of the village, several test wells were driven on the Marshall farm in order to ascertain the possibility of obtaining a sufficient and satisfactory supply from wells in that locality. The location of these wells is such that it is difficult to predict the sufficiency of the yield and, while the water thus obtained would probably be of a satisfactory sanitary quality, it was found to contain considerable amounts of hydrogen sulphide, thus rendering the water decidedly objectionable from an esthetic point of view. In order to render this water suitable for domestic consumption, filtration and aeration would be necessary.

At the time of the inspection, samples of water were collected from the Otter creek supply, from one of the wells at the pumping station, and from the mixed supply. The results of the analyses of these samples together with others made in the past by the Division of Laboratories and Research will be found in the appended table.

All of the analyses made of the samples collected previous to the time of the inspection are of the mixed supply. These analyses show a water high in color, very hard, and at times turbid. The total numbers of bacteria are in most cases excessive and organisms of the B. coli type are uniformly present in 10 c. c., frequently in 1 c. c., and occasionally in 0.1 c. c. samples, thus indicating active contamination of animal or human origin. The single set of analyses of the different sources of supply would indicate that the supply from Otter creek is the source of the high color, frequent turbidity, and unsatisfactory bacterial results. Both supplies are very hard and comparatively high in chlorine, although the chlorine figures are probably affected by local salt deposits. The water from Otter creek contains a considerable amount of organic matter, probably mainly of vegetable origin. The single analysis of the well water supply is satisfactory from a sanitary viewpoint, being low in total number of bacteria and with organisms of the B. coli type absent in 30 c. c.

In view of the above facts, the following conclusions may be drawn:

1. That the present well supply of Albion is probably of a reasonably satisfactory quality although certain improvements in the vicinity of the wells should be carried out as hereinafter set forth.
2. That Otter creek with proper development and conservation will probably yield a supply of sufficient quantity.
3. That the sanitary quality of the water of Otter creek is depreciated by the occurrence of numerous sources of contamination on the watershed, namely, surface wash from pastures, cultivated land, highways, barnyards, etc., and in one case from a privy directly on the bank of the stream.
4. That the sources of contamination on this watershed may be controlled by proper sanitary measures so as to afford a satisfactory raw water for treatment by a modern purification plant.
5. That the Marshall wells, although apparently capable of furnishing a supply reasonably free from contamination, do not furnish a water satisfactory from an esthetic standpoint due to the occurrence of hydrogen sulphide. Furthermore, it cannot be predicted with certainty that a sufficient yield will be obtained at all times and under all conditions.
6. That the use of the Erie canal for an emergency supply constitutes a serious menace to the health of the community at such times as it becomes necessary to draw upon this source.

I would therefore recommend:

1. That improvements be made by the village authorities in the vicinity of the well at the main pump station by:
   (a) Protecting the storage basin from surface wash by proper grading, draining ditches, and fences.

(b) Providing the living quarters of the engineer with a privy with removable containers located to the east of the pumping station at least 100 feet from any of the wells or else with a watertight cesspool, the contents of which could be carefully removed at such intervals as might be found necessary to prevent overflow and said contents be disposed of at some point at least 1,000 feet distant from any of the wells.

2. That in case Otter creek is continued as a source of supply, it be purified by some modern form of filtration plant supplemented by the use of hypochlorite of lime or liquid chlorine for final sterilization for both supplies.

3. That the village authorities take steps to control and remove, where necessary, sources of contamination upon the watershed and, in case, any difficulty be experienced in controlling this contamination, they should apply to this department for the enactment of Rules and Regulations for the sanitary protection of the watershed.

4. That as soon as an auxiliary supply for fire protection becomes unnecessary, the village abandon and remove the auxiliary intakes from the Erie canal.

Respectfully submitted,

THEODORE HORTON,
Chief Engineer

ALBANY, N. Y., *May* 18, 1915

RESULTS OF WATER ANALYSES

Abbreviations used to describe odors of water: 0, none; 1, very faint; 2, faint; 3, distinct; 4, decided; 5, strong; 6, very strong; a, aromatic; d, disagreeable; e, earthy; f, fishy; g, grassy; m, musty; v, vegetable

Municipality	County	Source of sample	Date of collection	Physical				Chemical (Parts per Million)											Bacteriological			
						Odor		Solids			Nitrogen as—						Hardness			B. Coli Type + = present — = absent		
				Color	Turbidity	Cold	Hot	Total	Loss on ignition	Mineral residue	Free ammonia	Albuminoid ammonia	Nitrites	Nitrates	Oxygen consumed	Chlorine	Total	Alkalinity	Bacteria per c.c.: gelatin 20°; 48 hours	10 c.c.	1 c.c.	1-10 c.c.
Albion	Orleans	Tap, public supply	2/4/11	5	2	....	....	344	60	184	.006	.018	.001	2.40	1.70	15.75	182.8	181.0	30	—	—	—
Albion	Orleans	Tap, public supply	4/13/11	10	Tr.	....	....	290	57	233	.008	.034	.001	4.00	1.80	14.75	191.4	157.0	130	—	—	—
Albion	Orleans	Tap, public supply	6/3/11	25	5	....	....	328	65	263	.026	.170	.001	0.80	6.60	12.25	214.5	191.0	275	+	+	+
Albion	Orleans	Tap, public supply	7/14/11	15	5	....	....	339	91	248	.004	.040	.001	0.80	2.40	11.75	180.0	154.0	250	+	+	—
Albion	Orleans	Tap, public supply	9/20/11	5	Cl.	....	....	335	74	261	.002	.060	.001	0.60	3.00	14.50	180.0	160.0	160	+	+	—
Albion	Orleans	Tap, public supply	10/30/11	20	5	....	....	286	19	267	.004	.192	.001	1.20	4.30	20.75	214.5	153.0	300	+	+	—
Albion	Orleans	Tap, public supply	12/5/11	15	Cl.	....	....	211	30	181	.032	.152	.001	1.60	3.10	14.50	180.0	165.0	120	+	—	—
Albion	Orleans	Tap, public supply	1/29/12	20	Cl.	....	....	480	27	453	.024	.098	.004	2.60	3.40	16.00	300.0	169.0	500	+	+	—
Albion	Orleans	Tap, public supply	3/4/12	18	Cl.	....	....	367	69	298	.012	.102	.003	2.40	3.90	13.5	185.8	155.0	3,400	+	—	—
Albion	Orleans	Tap, public supply	3/8/12	25	Tr.	....	....	420	63	347	.025	.096	.002	2.80	3.60	12.5	300.0	165.0	....	....	....	....
Albion	Orleans	Tap, public supply	3/26/12	25	Tr.	....	....	261	55	206	.026	.184	.004	2.80	5.30	8.25	182.0	111.0	6,900	+	+	—
Albion	Orleans	Tap, public supply	4/22/12	35	Tr.	....	....	383	70	313	.006	.146	Tr.	2.40	5.10	13.50	271.5	151.0	2,900	+	—	—
Albion	Orleans	Tap, public supply	5/1/12	20	Tr.	....	....	366	57	309	.006	.122	Tr.	2.00	4.90	13.25	271.5	164.0	500	+	—	—
Albion	Orleans	Tap, public supply	5/29/12	45	10	....	....	341	26	315	.010	.118	Tr.	2.40	6.70	12.50	171.4	159.0	210	+	+	—
Albion	Orleans	Tap, public supply	6/27/12	22	2	....	....	391	13	278	.004	.094	.001	1.70	5.00	14.0	191.4	190.0	3,000	+	—	—
Albion	Orleans	Tap, public supply	9/18/12	15	1	....	....	434	27	407	.004	.116	.001	1.00	4.50	15.0	228.5	189.0	6,100	+	+	—
Albion	Orleans	Tap, public supply	11/21/12	20	20	....	....	335	66	269	.014	.132	Tr.	1.20	4.30	15.0	191.4	160.0	4,100	+	+	—
Albion	Orleans	Tap, public supply	1/8/13	25	15	....	....	262	....	....	.018	.112	.002	2.40	4.60	13.25	177.2	152.0	2,600	+	+	+
Albion	Orleans	Tap, public supply	2/28/13	35	10	....	....	346	....	....	.024	.168	.001	2.60	6.00	9.75	228.5	141.0	6,700	+	—	—
Albion	Orleans	Tap, public supply	4/11/13	18	2	....	....	321	....	....	.014	.106	Tr.	3.00	4.00	12.25	243.0	158.0	1,200	—	—	—
Albion	Orleans	Tap, public supply	5/30/13	15	5	....	....	345	....	....	.016	.080	.001	1.70	2.90	14.00	208.0	197.0	950	+	+	—
Albion	Orleans	Tap, public supply	7/29/13	27	Tr.	....	....	341	....	....	.004	.188	Tr.	0.90	5.70	11.75	228.5	184.0	....	+	+	—
Albion	Orleans	Tap, public supply	4/22/14	18	5	1 v.	1 v.	346	63	283	.008	.138	.001	2.50	5.40	13.0	228.5	163.0	300	+	+	—
Albion	Orleans	Otter creek discharge pipe	5/11/15	22	3	1 a.	1 a.	410	59	351	.002	.198	.001	0.10	13.0	8.25	307.0	189.0	240	3+0—	0+3—	0+3—
Albion	Orleans	Well at pump station	5/11/15	Tr.	Cl.	1 v.	1 v	347	52	295	Tr.	.006	.001	2.80	1.00	16.50	228.5	167.0	15	0+3—	0+3—	0+3—
Albion	Orleans	Mixed well and creek water as pumped to village	5/11/15	....	....	....	....	....	....	....	....	....	....	....	....	14.00	......	......	150	2+1—	0+3—	0+3—

AMITYVILLE

HERMANN M. BIGGS, M.D., *State Commissioner of Health:*

An investigation of the public water supply of Amityville, L. I., was made by Mr. C. M. Baker, assistant engineer, on May 13, 1915.

Amityville is located along the south shore of Long Island in Suffolk county on the Montauk branch of the Long Island R. R. about 34 miles from New York city. The resident population of the village is about 3,000, increasing, however, to about 3,300 during the summer months.

The water supply is owned and controlled by the Amityville Water Works Company and the supply consists of wells from which the water is pumped into a standpipe whence it is distributed by gravity through the mains to the consumers. The plant is located along the railroad track slightly to the west of the center of the village. About 80 per cent. or 2,400 of the winter population and 2,640 of the summer population are served with the water. There is a total of 450 service taps of which only two are metered. The water consumption averages about 120,000 gallons daily during the winter and about 217,000 gallons during the summer, corresponding to the per capita rates of 50 and 82 gallons per day respectively. The pressure ranges from 45 to 56 pounds per square inch depending upon the elevation of the water in the standpipe, it being the practice, however, not to allow the pressure to fall below 45 pounds.

The wells consist of three 10-inch wells and one 6-inch well driven through sand to a depth of 60 feet, the water rising to within 12 or 14 feet of the surface. Two Dean pumps, one with a capacity of 300 gallons per minute, electrically driven, and the other with a capacity of 500 gallons operated by a gas engine, draw the water from the wells and force it into the standpipe. There is also a set of old pumps having a total capacity of 750 gallons per minute which can be put into operation in case of emergency. The suction lift for the pumps varies from 2 to 5 feet. The standpipe is 20 feet in diameter and 125 feet high and has a capacity when full of about 300,000 gallons. At present there is a total of some 11 miles of water mains varying in size from 4 to 10 inches in diameter.

The density of the population within one-quarter of a mile of the wells is equivalent to about 1,050 people per square mile and within one-half mile, 760 per square mile. Outside of this area and within the limits of the probable area affected by the wells the population will average approximately 150 per square mile. The sources of pollution in the immediate vicinity of the wells consist of a privy which is provided with a removable wooden box and is located about 75 feet from the nearest well, another privy located 100 feet from the wells, and the privy of the Long Island R. R. station located about 250 feet distant and which is not provided with a removable container. The condition of this latter privy was especially unsatisfactory at the time of the inspection. Other sources of pollution are more remote, there being no other houses within a distance of 400 or 500 feet. The ground about the plant is well elevated so that the drainage is away from the wells.

A sample of water was collected at the pumping station and sent to the Division of Laboratories and Research for analysis, the results of which are given on the following page.

The results of the analysis show low figures for the ammonias and nitrites but the figure for nitrates and chlorine are considerably above normal. The number of bacteria found present, namely, 10 per c. c., is low and organisms of the B. coli type were not found present.

The high nitrates and chlorine indicate that pollution is finding its way into the ground water supplying the wells although the low figures for the ammonias and nitrites, also the low bacterial content and the absence of the coli type, indicate that the water has been well purified by its passage through the soil. Nevertheless, the existence of this evidence of past contamination of the ground water renders it necessary to regard with some suspicion the sanitary quality of the supply; since it is uncertain whether

the purifying action of the soil will continue effective at times when the ground water flow is at a maximum, due to seasonal variation or at times of maximum drafts on the wells when the direction of flow is changed and the velocity increased over a certain area. Increased pollution of the ground water due to increasing population in the vicinity of the wells will also, doubtless, eventually affect the quality of the supply.

Report of Water Analysis for Amityville

Laboratory No.		
Source		Tap at pumping station
Collected on		5-13-15
Color		Trace
Turbidity		Clear
Odor, cold		1 v
Odor, hot		1 v
Solids, total		54
Loss on ignition		12
Mineral residue		42
Ammonia, free		.002
Ammonia, albuminoid		.040
Nitrites		Trace
Nitrates		1.60
Oxygen consumed		0.50
Chlorine		8.25
Hardness, total		14.30
Alkalinity		4.00
Iron		0.05
Bacteria per c.c		10
B. coli type	10 c.c.	0+3—
	1 c.c.	0+3—
	1/10 c.c.	0+3—

Results are expressed in parts per million. + Present. — Absent.
Abbreviations used to describe odors of water: 0, none; 1, very faint; 2, faint; 3, distinct; 4, decided; 5, strong; 6, very strong; a, aromatic; d, disagreeable; e, earthy; f, fishy; g, grassy; m, musty; v, vegetable.

It is unfortunate that the wells are located so near the center of a dense population, especially under the present methods of sewage disposal by means of cesspools and privies. In order to improve the unsatisfactory conditions and thus protect the supply from pollution it seems necessary that all sources of pollution in the vicinity of the wells be removed. Analyses of the water should also be regularly made occasionally to determine the presence of any active contamination which may occur.

In conclusion I would therefore state that although the public water supply at Amityville did not appear to be dangerously contaminated at the time of the inspection, there nevertheless exist potentially dangerous sources of pollution which may under certain conditions cause active and dangerous contamination. In view of these facts I beg to recommend:

1. That the water company take steps immediately to have all privies within a radius of not less than 500 feet of the wells provided with watertight containers and all cesspools made watertight and that the contents of these receptacles when emptied be removed to some remote place and satisfactorily disposed of.

2. That analyses of the water be occasionally made during the year to detect the presence of any active contamination which may occur.

3. That should such active contamination be found present, the company proceed immediately to carry out the following measures:

   (a) To determine and eliminate the sources of pollution if possible, or

   (b) Purify or sterilize the supply by liquid chlorine or other satisfactory method.

   (c) Should the above improvements fail to render the supply satisfactory new wells of other supply, free from any contamination, be developed.

The installation of a sewerage system, properly designed and constructed, which should receive all sewage from the vicinity of the wells would undoubtedly be the most satisfactory method of removing the sources of pollution and thus improving the water supply, and it would seem, therefore, that the water company and village officials should carefully consider the construction of such a system at an early date.

Respectfully submitted,

THEODORE HORTON,
Chief Engineer

ALBANY, N. Y., *June* 18, 1915

AMSTERDAM

HERMANN M. BIGGS, M.D., *State Commissioner of Health:*

A reinspection of the public water supply of Amsterdam was made in November, 1914, by Dr. James S. Walton, sanitary supervisor of District "J," and the following facts are based largely upon information furnished by him. A previous investigation of this water supply was made in 1909 by the engineering division in connection with an investigation of the prevalence of typhoid fever in the city at that time. A full report on this earlier investigation will be found on page 270, volume 2 of the thiritieth annual report of this Department.

The water supply of Amsterdam is derived from Hans creek about 15 miles northeast of the city. Formerly an additional supply was obtained from the McQueen and Rogers creeks, but these streams were abandoned as sources of water supply some time ago. The present population of the city is estimated at 37,500 and the daily water consumption is approximately 7,000,000 gallons. The water works are owned and operated by the city.

There are two reservoirs located on Bunn creek in the northern part of the city. These reservoirs at one time impounded the waters of this creek for water supply purposes, but this creek was finally abandoned due to the increase of population upon its watershed and the creek water by-passed around both reservoirs. The upper reservoir (Kellog) is not now used except for reserve storage in case of emergency. The lower reservoir (distribution) receives water from Hans creek, and distributes it to the low service system. The hill portion of the city receives water directly from the pipe line from Hans creek. There is some opportunity for surface wash into the lower reservoir from the small area adjacent to it below the diverting wall at which the 36-inch by-pass for Bunn creek commences. This by-pass is probably sufficiently large except possibly during times of heavy run-off.

On Hans creek there are three large storage reservoirs in addition to the reservoir formed by the diverting dam. The description of these reservoirs remains the same as in the previous report. From the diverting dam two pipe lines lead to the city, one of vitrified tile 20 inches in diameter, and the other of cast iron 30 inches in diameter.

The watershed area of Hans creek above the diverting dam is approximately 35 square miles. This area consists mainly of wooded hills, uninhabited and free from permanent sources of pollution. There is considerable swampy land in the valley of the stream and decaying vegetable organic matter in the swamps gives the water a deep amber color.

The previous report pointed out that the supply then being obtained from McQueen and Rogers creeks was at times subject to marked pollution, but that the supply from Hans creek appeared to be of a satisfactory and wholesome quality. It was therefore recommended that the McQueen and Rogers creeks be abandoned and that Hans creek be relied upon entirely for water supply. It appears then from the report of Dr. Walton that this recommendation has been carried out.

At the time of his inspection samples of the supply were collected by Dr. Walton and the results of the analyses of these samples together with others made in the past by the Division of Laboratories and Research will be found in the appended table.

These analyses show a water highly colored, comparatively soft and at times somewhat turbid. The bacterial results in the past have been at times rather unsatisfactory as shown by the high bacterial counts and the occurrence of organisms of the B. coli type in samples as small as one c. c., and occasionally in 1/10 c. c. The samples showing the highest counts and the most frequent occurrence of B. coli are usually those collected from the low service system below the distribution reservoir. As a rule samples of the water distributed directly from Hans creek show lower bacterial counts and less frequent occurrence of B. coli. It seems probable that at times of heavy rainfall a certain amount of contamination due to surface wash from its vicinity reaches the distribution reservoir. The unsatisfactory results evident in the earlier years were probably due to the use of contaminated water from the McQueen and Rogers creeks.

In view of the above facts the following conclusions may be drawn:

1. That the recommendations of this Department have been carried out in respect to the abandonment of the McQueen and Rogers creeks.

2. That the present supply from Hans creek (although very high in color) is of a reasonably satisfactory sanitary quality, but, as is true of all surface supplies, is open to accidental, incidental of wilful contamination from hunters, fishermen and other chance visitors upon the watershed.

3. That the water in the distribution reservoir in the northern part of the city is apparently open to contamination from surface wash from adjacent property and possibly from overflow from Bunn creek at times of heavy rainfall.

I would therefore recommend:

1. That the city authorities take steps to prevent contamination of the distribution reservoir by adequate drainage ditches to carry off and prevent all surface wash reaching it, and by constructing, if necessary, an additional and adequate by-pass for Bunn creek in order to care for maximum storm flows.

2. That owing to the ever present possibility of chance contamination upon the watershed the city provide some method of sterilizing the supply by liquid chlorine or hypochlorite of lime.

Respectfully submitted,

THEODORE HORTON,
Chief Engineer

ALBANY, N. Y., *May* 8, 1915

RESULTS OF WATER ANALYSES

Abbreviations used to describe odors of water: 0, none; 1, very faint; 2, faint; 3, distinct; 4, decided; 5, strong; 6, very strong; a, aromatic; d, disagreeable; e, earthy; f, fishy; g, grassy; m, musty; v, vegetable

Municipality	County	Source of sample	Date of collection	Physical: Color	Physical: Turbidity	Physical: Odor Cold	Physical: Odor Hot	Chemical (Parts per Million): Solids Total	Solids: Loss on ignition	Solids: Mineral residue	Nitrogen as— Free ammonia	Nitrogen as— Albuminoid ammonia	Nitrogen as— Nitrites	Nitrogen as— Nitrates	Oxygen consumed	Chlorine	Hardness: Total	Hardness: Alkalinity	Bacteriological: Bacteria per c.c.: gelatin 20°, 48 hours	B. Coli Type (+ = present, — = absent): 10 c.c.	1 c.c.	1-10 c.c.
Amsterdam	Montgomery		3/17/11																2,600	+	+	—
Amsterdam	Montgomery		4/ 5/11	30	20			72	40	32	.114	.196	.003	0.20	9.00	1.25	23.4	22.0	24,000	+	+	—
Amsterdam	Montgomery		3/ 3/11	65	5			51	29	22	.016	.138	.001	0.10	10.20	0.50	18.2	13.0	20,000	+	+	—
Amsterdam	Montgomery		7/ 7/11	80	5			70	18	52	.008	.088	.001	Tr.	10.80	0.75	28.6	28.0	20,900	+	+	—
Amsterdam	Montgomery		8/31/11	35	5			56	16	40	.006	.124	.001	0.10	7.80	1.00	18.2	18.0	700	+	+	+
Amsterdam	Montgomery		10/24/11	40	8			64	20	44	.020	.150	Tr.	0.10	11.80	3.50	28.6	12.0	500	+	+	+
Amsterdam	Montgomery		12/20/11	55	5			95	20	75	.012	.138	Tr.	0.40	9.40	1.75	37.7	27.0	1,800	+	+	—
Amsterdam	Montgomery	Tap	2/ 2/12	52	Tr.			47	19	28	.018	.030	Tr.	0.26	9.60	2.25	20.8	11.0	325	+	+	—
Amsterdam	Montgomery	Tap	3/15/12	35	Cl.			51	28	23	.040	.102	.001	0.36	7.40	1.00	22.1	11.0	2,000	+	—	—
Amsterdam	Montgomery	Tap	4/ 6/12	25	15			50	14	36	.040	.118	.002	0.24	6.40	1.00	23.4	12.0	15,000	+	+	+
Amsterdam	Montgomery	Tap	6/21/12	60	8			38	11	27	.010	.128	.001	0.04	8.30	0.75	18.2	9.0	180	+	+	—
Amsterdam	Montgomery	Tap	11/ 1/12	75	20			70	36	34	.026	.214	Tr.	0.10	15.20	1.00	32.5	13.0	3,100	+	+	—
Amsterdam	Montgomery	Tap	12/12/12	65	3			56	30	26	.018	.128	Tr.	0.14	11.20	1.50	23.4	8.0	180	+	—	—
Amsterdam	Montgomery	Tap, public supply	1/24/13	45	3			32			.022	.100	.001	0.16	7.40	1.25	16.9	7.0	3,500	+	—	—
Amsterdam	Montgomery	Tap, public supply	3/ 5/13	30	3			38			.004	.030	Tr.	0.12	6.10	0.75	14.3	4.0	1,800	+	—	—
Amsterdam	Montgomery	Tap, public supply	4/ 5/13	50	8			41			.030	.104	.001	0.10	7.50	1.00	19.5	1.0	325	+	—	—
Amsterdam	Montgomery	Tap, low service	4/17/13	35	35			88			.048	.138	.001	0.20	7.50	1.50	39.0	30.0	2,800	+	+	—
Amsterdam	Montgomery	Tap, Hans Creek supply	4/18/13	40	Cl.			38			.020	.102	.001	0.14	6.80	0.75	14.3	6.0	300	—	—	—
Amsterdam	Montgomery	Tap, distributing reservoir	5/ 2/13	45	2			56			.008	.112	Tr.	0.16	7.10	1.00	31.2	22.0	1,100	+	+	+
Amsterdam	Montgomery	Tap, Hans Creek supply	5/ 2/13	50	Cl.			45			.014	.128	Tr.	0.10	7.80	0.75	18.2	3.0	350	+	+	—
Amsterdam	Montgomery	Tap, public supply	6/13/13	65	10			124			.022	.130	Tr.	0.06	9.10	0.75	20.8	14.0	180	+	—	—
Amsterdam	Montgomery	Tap	5/ 8/14	45	Tr.	2 a.	2 a.	32	10	22	.008	.100	Tr.	0.20	8.80	0.25	18.2	7.0	160	1+2—	0+3—	0+3—
Amsterdam	Montgomery	Tap, Hans Creek supply	11/ 2/14	60	Tr.	1 v.	1 v.	40	13	27	.006	.108	.001	0.10	8.40	0.75	26.0	5.0	250	0+3—	0+3—	0+3—
Amsterdam	Montgomery	Tap, distributing reservoir	11/ 2/14																130	2+1—	0+3—	0+3—
Amsterdam	Montgomery	Tap, distributing reservoir	11/ 2/14	30	5	1 v.	1 v.	57	12	45	.008	.106	.001	0.10	8.50	1.25	40.3	*8.00				

* Acidity.

ANDES

HERMANN M. BIGGS, M.D., *State Commissioner of Health:*

An investigation of the public water supply of the village of Andes was made on August 31, 1915, by Mr. C. M. Baker, assistant engineer, assisted by Dr. C. C. Duryee, sanitary supervisor of District "C."

The incorporated village of Andes is located in the town of Andes, Delaware county, at the terminal of the Andes branch of the Delaware & Northern Railroad. The country is mountainous and the principal industry is dairying. The present population of the village is approximately 420.

The supply is owned and controlled by the Andes Water Company and was originally developed in 1876, at which time the supply consisted of a large spring located about ½ mile east of the village from which water flows into a nearby reservoir whence it is distributed by gravity to the village. This supply becoming somewhat inadequate, however, was increased in the summer of 1910 by two additional springs located about ½ mile northeast of the original spring. The water from these springs is conducted by gravity to the reservoir mentioned above. Approximately 90 per cent. of the inhabitants are served with the water. There are some 80 service taps, none of which are metered. The amount of water consumed is very indefinite, there being no meters or other method of measuring the consumption. Based, however, on 100 gallons per capita the total daily consumption would be 38,000. The average pressure at the village is about 80 pounds per square inch.

The main or original spring is located at the foot of a hill about 40 acres in area and used as a meadow. Back of this hill is a large mountain. The contour of the hill above the spring is such that the surface wash from only a small portion of it could naturally find its way into the spring or reservoir and drainage ditches are constructed for the purpose of diverting the surface wash even from this small area. The reservoir is about 46 feet square and has a capacity of approximately 125,000 gallons. The water from the spring flows into a box strainer located in the upper end of the reservoir and the intake supplying the village receives its supply from the bottom of this strainer. It is thus apparent that when the supply from this spring is sufficient the majority of the water supplied to the village is derived from the main spring. The water mains consisting of about 1½ miles of pipe range in size from 3 to 6 inches in diameter, the main leading from the reservoir to the village being constructed of 6-inch pipe.

The Murray spring, which is one of the supplies recently developed and is only used to augment the supply at times of drought, is located in a ravine or natural water course, and the intake consists of a small dam across the ravine from which the water is conveyed to the main reservoir. There are several springs which flow into the basin at the intake and although it is probable that there is considerable surface water flowing in the ravine at certain times, the only source during a period of drought, when this supply would be used, is from the springs. The area of the watershed tributary to these springs is about ½ square mile. There is one house on it, but it is located several hundred feet from the stream. The water was not being used from this source at the time of the inspection.

The Worden spring which is the second of the springs developed recently, is located about 300 feet from a farmhouse and although the company owns about ⅛ acre of land around the spring it is not fenced and free access is therefore allowed to the spring by any one in the vicinity. A small basin is formed at this place by means of a concrete dam partly surrounding the spring. There is, however, another small spring located slightly above, which flows into it. Above the springs is pasture land and the contour is such that only a limited area drains from it toward the spring. There are, however, no drainage ditches to divert the surface wash from this area. There was considerable green algae growth in the basin at the time of the inspection but so far as could be learned no serious trouble has yet been experienced

from the source. Although this supply was turned on at the time of the inspection it is probable that due to the arrangement of the intake from the reservoir, described above, the water supply for the village was then being derived principally from the main spring located near the reservoir.

Samples of the water were collected from each of the springs and also from a tap in the village and sent to the Division of Laboratories and Research for analyses, the results of which are as follows:

REPORT OF WATER ANALYSIS FOR ANDES

Source		Tap	Main spring	Murray spring	Worden spring
Collected on		8/13/13	....	....	....
Color		Trace	....	....	....
Odor, hot		1 v	....	....	....
Odor, cold		1 v	....	....	....
Turbidity		Trace	....	....	....
Solids, total		30	....	....	....
Loss on ignition		3	....	....	....
Mineral residue		27	....	....	....
Ammonia, free		.010	....	....	....
Ammonia, albuminoid		.020	....	....	....
Nitrites		.003	....	....	....
Nitrates		0.16	....	....	....
Oxygen consumed		1.80	....	....	....
Chlorine		1.50	....	....	....
Hardness, total		15.6	....	....	....
Alkalinity		13.0	....	....	....
Bacteria per c.c.		35	100	5,000	13,500
B. coli type	10 c.c.	1+2—	1+2—	3+0—	3+0—
	1 c.c.	0+3—	0+3—	1+2—	3+0—
	1/10 c.c.	0+3—	0+3—	0+3—	2+1—

Results are expressed in parts per million. + Present. — Absent.

Abbreviations used to describe odors of water: 0, none; 1, very faint; 2, faint; 3, distinct; 4, decided; 5, strong; 6, very strong; a, aromatic; d, disagreeable; e, earthy; f, fishy; g, grassy; m, musty; v, vegetable.

The results of these analyses show that the water collected from a tap in the village at the time of the inspection was then satisfactory regarding color, odor and turbidity; also that it is very soft. Only a moderate amount of organic matter was present and the bacterial content of 35 per c.c. was low with the B. coli type present in only one of the 10 c.c inoculations. The bacterial sample collected from the main spring showed similar results, but the sample collected from the Murray spring showed the presence of 5,000 bacteria per c.c. with the B. coli type present in all of the 10 c.c. and one of the 1 c.c. inoculations, and the sample from the Worden spring showed the presence of 13,500 bacteria per c.c. with the B. coli type present in all of the 10 and 1 c.c. inoculations and in two of the 1/10 c.c. inoculations.

As a result of this investigation, I would draw the following conclusions:

1. That the sanitary conditions in the vicinity of the main or original spring and also the results of analyses of water collected from this source, indicate that this water was of a satisfactory, sanitary quality at the time of the inspection, but it is apparent that this supply is insufficient in quantity at certain times.

2. That the supply obtained from the Murray spring is subject to pollution from surface wash at times which is probably the cause of the high bacterial content and the presence of the B. coli type in the sample collected at the time of the inspection, since there had been considerable rain just prior to that time.

3. That the Worden spring is inadequately protected from pollution by surface wash from the pasture above it and also from people trespassing in the vicinity of the spring. This, together with the high bacterial content and the prevalence of the B. coli type in the sample collected at the time of the inspection, indicate that under present conditions, this supply is not of a satisfactory sanitary quality.

In view of the above, I beg to offer the following recommendations to be acted upon by the water company:

1. That drainage ditches be constructed to divert the surface wash as far as is practicable from the Murray spring.

(a) Land owned by the company about the spring be enclosed by a suitable fence for the purpose of excluding all persons, animals or fowls from the immediate vicinity of the spring.

(b) Suitable drainage ditches be constructed for the purpose of diverting all surface wash from this spring.

Respectfully submitted,
THEODORE HORTON,
Chief Engineer

ALBANY, N. Y., *October* 18, 1915

ARENA

HERMANN M. BIGGS, M.D., *State Commissioner of Health:*

An investigation of the public water supply of the village of Arena was made on September 1, 1915, by Mr. C. M. Baker, assistant engineer, accompanied by Dr. C. C. Duryee, sanitary supervisor of District "C."

Arena is an unincorporated village located in the town of Middletown, Delaware county, on the Delaware & Northern railroad about seven miles west of Arkville, the western terminus of the road. It is in a mountainous region and on the east branch of the Delaware river. The principal industry in this vicinity is dairying. The population at the time of the inspection was about 200.

The supply is owned by the Arena Water Company and as originally developed in 1892 consisted of a spring from which the water flowed into a small reservoir, whence it was distributed by gravity to the village. This plant is located about one mile north of the village. Later this supply was increased by an additional spring known as the Baker spring, located on the opposite side of the valley from the original spring and also by providing an intake from the small brook, which flows through the valley, for an auxiliary supply. The water from the springs and from the brook intake flows into the reservoir by gravity. About 75 per cent. of the population are served with the water. There are some forty service taps, none of which is metered. No definite information could be obtained regarding the water consumption since there are no meters or other means of measuring the amount used. The pressure in the village is about 70 pounds per square inch.

The original spring is located on the side of a mountain at the foot of a natural watercourse and is unprotected from surface wash. The area above, however, is heavily wooded and is uninhabited. The water flows from the spring by gravity to the reservoir about 400 feet distant. The reservoir is constructed of stone and concrete and has a capacity of about 38,000 gallons. It is uncovered. There is a farmhouse located above the reservoir but it was unoccupied at the time of the inspection and the contour of the land is such that surface drainage from it would be diverted from the reservoir. The reservoir is enclosed by a fence.

The Baker spring is located in a pasture field on the side of the mountain across the valley from the original spring. There is a fence around it but it is apparently inadequately protected from surface drainage. There are no inhabitants above.

The brook intake consists of a small well by the side of the brook into which the water is conveyed through a ditch whence it flows by gravity to the reservoir. The brook is fed to a considerable extent by springs and its watershed of about one square mile in area is precipitous and a large percentage of it is wooded. There are three houses on the watershed, all of which

are located several hundred feet from the stream. This supply was not being used at the time of the inspection and is only used occasionally at times of excessive droughts.

Samples of water were collected from each of the springs, the brook and from a tap in the vilage and sent to the Division of Laboratories and Research for analyses, the results of which are as follows:

REPORT OF WATER ANALYSIS FOR ARENA.

Source		Tap	Original spring	Baker spring	Baker spring	Brook
Collected on		9/1/15	9/1/15	9/1/15	9/1/15	9/1/15
Color		Trace	....	....	....	....
Odor, hot		1 v.	....	....	....	....
Odor, cold		1 v.	....	....	....	....
Turbidity		Clear	....	....	....	....
Solids, total		42	....	....	....	....
Loss on ignition		7	....	....	....	....
Mineral residue		35	....	....	....	....
Ammonia, free		.008	....	....	....	....
Ammonia, albuminoid		.032	....	....	....	....
Nitrites		.002	....	....	....	....
Nitrates		.160	....	....	....	....
Oxygen consumed		2.00	....	....	....	....
Chlorine		1.00	....	....	....	....
Hardness, total		19.50	....	....	....	....
Alkalinity		19.00	....	....	....	....
Bacteria per c.c.		40	30	1,300	....	60
B. coli type	10 c.c.	3+0—	2+1—	3+0—	....	3+0—
	1 c.c.	1+2—	0+3—	3+0—	....	1+2—
	1/10 c.c.	0+3—	0+3—	1+2—	....	0+3—

Results are expressed in parts per million. + Present. — Absent.

Abbreviations used to describe odors of water: 0, none; 1, very faint; 2, faint; 3, distinct; 4, decided; 5, strong; 6, very strong; a, aromatic; d, disagreeable; e, earthy; f, fishy; g, grassy; m, musty; v, vegetable

The results of the analyses show that the water collected from a tap in the village at the time of the inspection was then satisfactory in appearance and that it is quite soft. From a sanitary standpoint, however, this water contained a small amount of organic matter and although the total number of bacteria, 40 per c. c., is moderate, those of the B. coli type were found present in all of the 10 and one of the 1 c. c. inoculations. The water collected from the main or original spring showed the presence of 30 bacteria per c. c. with colon bacilli present in two of the 1 c. c inoculations and that from the Baker spring 1,300 bacteria with colon bacilli in all the 10 and 1 c. c. inoculations and in one of the 1/10 c. c. inoculations. Since the sample collected from the village tap is a mixture of water from both of these springs the pollution is probably due largely to that obtained from the Baker spring. The brook water was low in bacterial content for a surface supply, but colon bacilli were present in all the 10 and 1 of the 1 c. c. inoculations. The pollution in the spring waters is probably from stock in the vicinity which are also probably the principal cause of the pollution in the brook water.

As a result of this investigation the following conclusions may be drawn:

1. That the spring supplies, although showing some evidence of pollution at the time of the inspection, could be made to furnish a satisfactory quality of water if properly protected.

2. That the auxiliary supply obtained at times from the brook is apparently quite satisfactory in quality for a surface supply, but unless extreme precautions are taken to keep the watershed in a sanitary condition there is always the possibility of this supply becoming contaminated.

In view of the above it seems expedient to offer the following recommendations to be acted upon by the water company:

1. That suitable fences be constructed about each of the springs to keep stock from their immediate vicinity and also that adequate drainage ditches be constructed to divert the surface wash from the springs.

2. That the watershed tributary to the brook from which the auxiliary supply is derived be maintained at all times in a sanitary condition and furthermore whenever it is apparent that it will be necessary to pump water from the brook a thorough inspection be made of this watershed some time before the pump is put in operation to detect and abate any insanitary conditions which may have developed recently.

Respectfully submitted,
THEODORE HORTON,
Chief Engineer

ALBANY, N. Y., *October* 19, 1915

AUSABLE FORKS

HERMANN M. BIGGS, M.D., *State Commissioner of Health:*

A reinspection of the public water supply of Ausable Forks was made on October 27, 1914, by Dr. J. A. Smith, sanitary supervisor of District "A" and the following facts are based largely upon information furnished by him. A full report of a previous investigation made by the engineering division in 1912 will be found on page 637 of the thirty-third annual report of this Department.

The public water supply of Ausable Forks is derived by gravity from a stream rising in the hills north of the village, the intake dam being located about one mile northwest of the center of the village. The water works system remains practically the same as described in the previous report. There is very little reserve storage provided by the intake reservoir and an auxiliary supply for fire protection can be obtained by pumping directly from the Ausable river. The population of the village is about 2,000. No data are available as to the water consumption. The water works are owned and operated by the J. & J. Rogers Co.

The watershed above the point of intake is approximately 7.4 square miles in area and the resident population may be estimated at 55 or 8 per square mile. One farm formerly located some three miles above the intake and at which insanitary conditions existed has been purchased by the Rogers Company and the buildings removed. Along the highway paralleling the right bank of the stream directly above the intake are 14 houses, containing, it is estimated, in all some 50 people. The land slopes moderately toward the stream in the rear of these houses, which are distant from it about 400 feet. The eastern side of the watershed is thickly wooded and uninhabited for a distance of three-quarters of a mile or more above the intake. Farther up stream there are extensive swamp lands through which the stream flows.

At the time of the previous report it was pointed out that the sanitary quality of the supply was impaired somewhat by the resident population upon the watershed and that while there was probably no direct pollution of the water supply from human wastes opportunities for such pollution existed unless extreme care was exercised by those in control of the water works to prevent carelessness in the location of privies near watercourses and disposal of the contents on the watershed.

It was therefore recommended:

1. That a thorough inspection be made by the company controlling this public water supply of all parts of the watershed with a view of determining if any permanent, direct or dangerous pollution existed thereon.

2. That should any dangerous pollution be found to exist that it be abated and if any difficulty be experienced in suppressing such pollution the company apply to this Department for the enactment of rules and regulations for the sanitary protection of this water supply.

3. That frequent and regular inspections be made of the watershed of the village water supply to prevent all careless or accidental pollution.

From the report of Dr. Smith it appears that the water company has acted along the lines of the recommendations of this Department in the purchase of one farm and the removal of sources of pollution thereon although there has been no application to this Department for the enactment of rules and regulations.

At the time of his inspection Dr. Smith collected samples of water at several points along the stream and from a tap in the village. The results of the analyses of these samples together with others made in the past by the Division of Laboratories and Research will be found in the appended table.

These analyses show a water somewhat colored, at times turbid and moderately hard. The total numbers of bacteria are higher than can be considered satisfactory for a potable supply and the occurrence of organisms of the B. coli type in samples as small as 1 c. c. indicates active contamination of animal or human origin.

In view of the above facts the following conclusions may be drawn:

1. That the company controlling the water works have taken certain action along the lines recommended by this Department.
2. That notwithstanding the improvements that have been made on the watershed in respect to sanitary conditions, the water supply of this village is still subject to indirect contamination due to surface wash from manured fields, barns, highways and other sources incidental to a populated watershed.
3. That while the enforcement of sanitary regulations would tend to lessen the danger of contamination from permanent sources it cannot be depended upon to prevent accidental, incidental or wilful contamination by the resident population or chance visitors to the watershed.
4. That there is serious danger to the sanitary quality of the water supply should it become necessary to pump directly into the mains from the polluted Ausable river in case of fire.

I would therefore recommend that the company controlling the water works be urged to consider carefully the following recommendations:

1. Improve their present supply by the construction of sufficient storage to afford fire protection and thus avoid the necessity of pumping directly from the polluted Ausable river.
2. Install a modern filtration plant for the purification of their supply.
3. Pending the construction of such a filtration plant, install and operate some method for the sterilization of the supply with hypochlorite of lime or liquid chlorine.

Respectfully submitted,

THEODORE HORTON,
Chief Engineer

ALBANY, N. Y., *April* 28, 1915

RESULTS OF WATER ANALYSES

Abbreviations used to describe odors of water: 0, none; 1, very faint; 2, faint; 3, distinct; 4, decided; 5, strong; 6, very strong; a, aromatic; d, disagreeable; e, earthy; f, fishy; g, grassy; m, musty; v, vegetable

Municipality	County	Source of sample	Date of collection	Physical: Color	Physical: Turbidity	Physical: Odor: Cold	Physical: Odor: Hot	Chemical (Parts per Million): Solids: Total	Solids: Loss on ignition	Solids: Mineral residue	Nitrogen as—: Free ammonia	Nitrogen as—: Albuminoid ammonia	Nitrogen as—: Nitrites	Nitrogen as—: Nitrates	Oxygen consumed	Chlorine	Hardness: Total	Hardness: Alkalinity	Bacteriological: Bacteria per c.c.; gelatin 20°; 48 hours	B. Coli Type (+ = present, — = absent): 10 c.c.	B. Coli Type: 1 c.c.	B. Coli Type: 1-10 c.c.
Ausable Forks.	Essex	Tap, public supply	2/ 5/12	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	300	+	+	—
Ausable Forks.	Essex	Tap, public supply	2/ 8/12	15	Tr.	....	....	69	21	48	.016	.050	Tr.	0.16	2.70	0.37	39.0	34.0	275	+	—	—
Ausable Forks.	Essex	Sample at dam	5/25/12	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	800	+	+	—
Ausable Forks.	Essex	Tap, public supply	5/25/12	3	49	....	....	49	18	31	.006	.158	Tr.	0.06	12.20	0.75	19.5	15.0	1,150	+	+	—
Ausable Forks.	Essex	Brook 3 miles above intake	10/27/12	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	300	1+2—	0+3—	0+3—
Ausable Forks.	Essex	Brook before settling	10/27/12	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	230	1+2—	0+3—	0+3—
Ausable Forks.	Essex	Intake after settling	10/27/12	25	Cl.	1 v.	1 v.	66	17	49	.004	.040	.001	0.06	4.80	0.50	40.3	40.0	200	1+2—	0+3—	0+3—
Ausable Forks.	Essex	Tap, public supply	10/27/12	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	250	1+2—	0+3—	0+3—

AVOCA

HERMANN M. BIGGS, M.D., *State Commissioner of Health:*

A reinspection of the public water supply of Avoca was made by Dr. John A. Conway, sanitary supervisor of District "K" and the following facts are based largely upon information furnished by him. A full investigation of this supply was made by the engineering division in September, 1911, and the report of this investigation will be found on page 710 of the thirty-second annual report of this Department.

The water supply of this village is derived from several springs located about one and one-half miles west of the village in the valley of a small stream, called Cotton creek. A dam across the creek at this point forms a storage reservoir for the creek water for use in times of emergency only. The spring water supply is collected in two basins from which the water is led to a masonry reservoir located within and at one corner of the creek reservoir. A valve connects the two reservoirs so that if necessary creek water can be admitted to the inner reservoir and thence distributed to the village. The water works system remains practically the same as at the time of the previous inspection, save that now 95 per cent. of the population which is about 1,075 is served by the supply instead of 75 per cent. as formerly. No data are available as to daily water consumption as there are no meters whatever. The water works are owned and operated by the village.

The spring water supply is apparently free from ordinary sources of contamination. The land in the immediate vicinity of the collecting basins is owned by the village and no cattle are pastured nearby. Some waste of spring water occurs due to leakage at one of the collecting basins and it would seem advisable for this waste to be prevented in order that the possible need of the emergency supply from the creek might be lessened.

The watershed of Cotton creek above the reservoir is about 2.8 square miles in area. This area is moderately hilly and devoted to agriculture and of the seven or eight dwellings upon the watershed all but two or three are well away from the stream or its tributaries. Cattle have access to the stream and at times of rainfall there must be considerable organic pollution reaching the creek from manured fields and barnyards.

In the report of the previous investigation it was pointed out that more or less organic matter reached the creek supply from animal and possibly human sources, that algae growths occurred in the outer reservoir; that the spring water supply was probably of a good quality; but that the village was receiving at all ordinary times a mixture of creek and spring water owing to leaks in the wall between the two reservoirs and in view of these conclusions it was recommended:

1. That the village make the inner reservoir water-tight to prevent the inflow of creek water, as the latter while being a reasonably safe and desirable source of water supply, is probably inferior to the spring water supply.
2. That a separate intake be made for the creek water supply to be used independently of the spring water supply and only in emergency.
3. That a strict supervision and frequent inspection be made not only of the springs and their surroundings but also the watershed of the creek above the reservoir to protect the water from accidental pollution and that the local authorities be cognizant of the occurrence of sickness on the watershed in order that they may take immediate measures to prevent any possible infection of the water supply.
4. Finally, that if the board of water commissioners experience any difficulty in preventing any careless, wilful or unnecessary pollution of the water supply that they apply to this Department for the enactment of rules and regulations for the sanitary protection of the public water supply of the village.

From the inspection of Dr. Conway it appears that of these recommendations, action has been taken in respect to the first only, if any. While it is

evident that the prevention of leakage of creek water into the spring water reservoir is of first importance, it is also evident that the other recommendations are important even though the creek supply is required for emergency use at long intervals only.

At the time of the recent inspection samples of the village supply were collected by Dr. Conway and the results of the analyses of these samples together with others made in the past by the division of laboratories and research are given in the appended table.

These analyses show a water usually colorless, although at times slightly colored, usually free from turbidity and constantly very hard. The figures for nitrogen in the form of free and albuminoid ammonia and nitrites indicate small amounts of decomposable or decomposing organic matter. On the other hand the nitrate and chlorine results are high indicating considerable past organic pollution well purified by passage through the soil. This past pollution is probably due to pasture lands at greater or less distance from the springs.

The bacterial results are somewhat unsatisfactory especially some of the older results and may be due to leakage of creek water into the inner reservoir before this reservoir had been made free from leaks. The results of the analyses of the samples taken by Dr. Conway are more satisfactory and probably indicate the quality of the spring supply unmixed with surface water.

In view of the above facts the following conclusions may be drawn:

1. That, while one recommendation of the previous report has been carried out, apparently little, if any, action has been taken upon the other three.

2. That the regular water supply derived from the springs, if properly protected from chance contamination, should be of satisfactory sanitary quality and, save for its hardness, of good physical quality.

3. That the creek water supply, although practically free from direct sources of contamination, is subject to more or less indirect contamination from the inhabited dwellings upon the watershed.

4. That due to possibility of serious contamination of the creek supply its use should be limited to times of emergency only and in order to limit the use of the creek as much as possible the spring water should be conserved carefully.

I would therefore recommend:

1. That the local authorities consider carefully the recommendations of the previous report and take action along the lines suggested upon which they have not already acted.

2. That every means be taken to prevent leakage of waste of the spring water supply.

3. That, in case it becomes necessary to use the creek water supply this water be subjected to sterilization by some method of chlorination, either by use of hypochlorite of lime or liquid chlorine.

Respectfully submitted,

THEODORE HORTON,
Chief Engineer

ALBANY, N. Y., *January* 23, 1915

RESULTS OF WATER ANALYSES

Abbreviations used to describe odors of water: 0, none; 1, very faint; 2, faint; 3, distinct; 4, decided; 5, strong; 6, very strong; a, aromatic; d, disagreeable; e, earthy; f, fishy; g, grassy; m, musty; v, vegetable

Municipality	County	Source of sample	Date of collection	Physical				Chemical (Parts per Million)											Bacteriological			
						Odor		Solids			Nitrogen as—						Hardness		Bacteria per c.c.; gelatin 20°; 48 hours	B. Coli Type + = present — = absent		
				Color	Turbidity	Cold	Hot	Total	Loss on ignition	Mineral residue	Free ammonia	Albuminoid ammonia	Nitrites	Nitrates	Oxygen consumed	Chlorine	Total	Alkalinity		10 c.c.	1 c.c.	1-10 c.c.
Avoca	Steuben	Tap, public supply	9/15/11	Tr.	Cl.	....	....	198	....	157	.004	.026	Tr.	1.20	0.40	1.25	142.8	140.0	....	....	....	....
Avoca	Steuben	Tap, public supply	1/ 6/12	Tr.	Cl.	....	....	155	....	135	.022	.034	Tr.	1.60	0.30	1.87	134.2	128.0	800	+	—	—
Avoca	Steuben	Tap, public supply	2/14/12	5	Cl.	....	....	171	....	149	.024	.038	Tr.	2.00	1.90	1.87	137.2	132.0	250	+	—	—
Avoca	Steuben	Tap, public supply	3/22/12	15	Tr.	....	....	139	....	118	.004	.032	Tr.	1.36	1.40	1.00	117.2	100.0	13,500	+	—	—
Avoca	Steuben	Tap, public supply	10/ 7/12	10	Tr.	....	....	138	....	122	.004	.018	.001	1.20	1.60	1.25	120.0	119.0	11,500	+	—	—
Avoca	Steuben	Tap, public supply	11/25/12	Tr.	Cl.	....	....	158	....	139	.006	.026	Tr.	2.00	0.30	1.50	137.2	130.3	200	+	—	—
Avoca	Steuben	Tap, public supply	1/ 2/13	5	2	1 v.	1 v.	161	....	....	.006	.032	Tr.	1.40	0.90	2.00	145.8	122.0	1,200	—	—	—
Avoca	Steuben	Tap, public supply	3/12/13	10	10	1 v.	1 v.	175	....	....	.008	.046	Tr.	1.50	1.40	1.25	134.2	119.0	8,700	3+0—	0+3—	0+3—
Avoca	Steuben	Tap, public supply	5/ 2/13	Tr.	Tr.	1 v.	1 v.	173	....	....	.004	.010	Tr.	1.20	0.10	1.50	137.2	128.0	350	0+3—	0+3—	0+3—
Avoca	Steuben	Tap, public supply	6/ 9/13	Tr.	Cl.	1 v.	1 v.	169	....	....	.004	.004	Tr.	1.00	0.10	1.75	137.2	135.0	*....	1+2—	0+3—	0+3—
Avoca	Steuben	Tap, public supply	10/21/14	Tr.	Cl.	1 v.	1 v.	174	23	151	.002	.002	.001	1.00	0.60	2.13	148.6	137.0	50	0+3—	0+3—	0+3—
Avoca	Steuben	Tap, public supply	10/21/14	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	25	0+3—	0+3—	0+3—
Avoca	Steuben	Reservoir, spring supply	10/21/14	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	15	0+3—	0+3—	0+3—

* Delayed in transit.

BAINBRIDGE

Hermann M. Biggs, M.D., *State Commissioner of Health:*

An investigation of the public water supply of the village of Bainbridge, Chenango county, was made on June 30, 1915, by Mr. E. S. Chase, assistant engineer in this Department. The assistant engineer was accompanied and aided on this inspection by Mr. A. L. Lilley, water commissioner.

Bainbridge is an incorporated village with a population of about 1,200 located in the southern part of Chenango county, on the banks of the Susquehanna river and on the D. & H. R. R., about 110 miles southwest of Albany. The village is the center of a prosperous farming district and is a center for dairy products. There are two or three factories manufacturing casein, milk sugar and other milk products. The village is partly sewered by a privately owned sewerage system.

The water supply of the village is derived principally from Yaleville creek, an upland stream rising in the hills several miles northwest of the village and flowing into the Susquehanna river about one mile east of the village center. The gravity pressure obtainable from this source is somewhat insufficient for fire protection and an auxiliary supply for emergency purposes is obtainable from Newton creek, the intake of which is located about a mile north of the village center. A few houses are also supplied with this water but under ordinary conditions it is not introduced into the village mains. At times of extreme drought an additional supply may be obtained from two deep wells owned by the International Milk Sugar Company and located at their factory in the village. The Yaleville creek supply is filtered by means of pressure mechanical filters.

The water works were constructed about the year 1900 and the filter plant about 1907. Nearly the entire population of the village is supplied by the system. The amount of water consumed is unknown as there are no meters or other method of measuring the consumption. A large amount of water is used intermittently by the D. & H. R. R. With the exception of the well supply, which is pumped, the water is distributed by gravity through 7½ miles of water mains ranging in size from 3 to 8 inches in diameter. There are 335 service taps, none of which is metered. The water works are owned and operated by the village under the direction of the board of water commissioners of which Mr. R. W. Kirby is chairman.

The Yaleville creek intake is located two miles northeast of the village and is formed by a concrete dam about 100 feet long and 6 feet high making a small reservoir about one-quarter acre in area and 3 or 4 feet deep with an estimated capacity of approximately 200,000 gallons. The water is obtained through a system of collecting tile with open joints in the bottom of the reservoir, these tile being covered with a layer of gravel. From this collection system of tile the water passes into a small concrete well, thence into a concrete settling basin approximately 10 x 15 x 8 feet and thence into a pipe line leading to the filter plant.

The filter plant is located in the eastern part of the village and consists of three 6½ feet inside diameter New York Continental Jewell pressure mechanical filters housed in a one-story masonry building. These filters were designed for a capacity of 100,000 gallons per 24 hours each or a rate of 130,000,000 gallons per acre per 24 hours. The filter media consists of a bed of silica, sand and gravel, 3 feet in depth. There are, however, no meters connected with the plant and it is impossible to state the actual rates of operation. Sulphate of aluminum is used as a coagulant, it being applied by the well known shunt system. The rate of application is unknown, the method being to keep the alum drums filled and shunt valves partly open. The filters are washed every day by reverse flow for about 15 minutes for each filter.

The intake of the Newton Creek supply consists of a low masonry dam across the stream which diverts the water into a small triangular-shaped basin constructed of masonry. From this basin the water is carried through a pipe line to a settling basin similar to the one at Yaleville creek and thence the water flows to a reservoir located near the northern boundary of the village. The pipe line from this reservoir is connected with the distribution

system of the village, but under ordinary conditions a valve in the line is kept closed, thus preventing the intermingling of the Newton creek water with the filtered water. This reservoir is 120 feet long by 30 feet wide and 8 feet deep with an estimated capacity of 220,000 gallons.

At the sugar factory there are two wells 200 feet deep with 6-inch casings. These wells are located in the southern part of the village about 200 feet from the bank of the Susquehanna river. The wells are said to be drilled through gravel only and the water level to be about 8 feet below the surface of the ground. These wells are used continuously for the purposes of the factory but only occasionally by the village. At times of fire however the water from these wells is pumped directly into the village distribution system by means of a horizontal plunger duplex pump with a capacity of 750 gallons per minute. Although the wells are owned by the sugar company, this pump is owned by the village.

Yaleville creek above the intake has a watershed area of about 15 square miles. Upon this area there are in the neighborhood of 70 occupied dwellings and the population may be estimated at 350, or 23 per square mile. This area consists of an irregularly-shaped valley, the side slopes of which are fairly steep and high. Fully 80 per cent of the drainage area is cleared land devoted to agriculture and grazing. The soil is clay and gravel overlying a substrata of shale. There is practically no swampy or marsh land except for a small amount in the immediate vicinity of the stream.

The area is traversed by several highways, along which the various dwellings are scattered. Practically all of these houses are fairly distant from the stream and the principal contamination to which the stream is subjected is that brought about by surface wash at times of heavy rainfall. As is true of all populated watersheds, there are numerous opportunities for intermittent contamination of the stream by the resident and transient population upon the drainage area. There is also opportunity for contamination by surface wash from manured fields, pasture lands and highways.

The watershed of Newton creek above the intake is approximately 3 square miles in area. There are about 30 houses on this watershed and the population may be estimated at 65, or 22 per square mile. The character of this watershed is similar to that of Yaleville creek and practically all the houses are at a considerable distance from the stream. The opportunities for contamination are also the same as those existing along the larger stream.

The wells of the sugar factory are located in the outskirts of a thickly settled neighborhood. The location of wells in a thickly settled community renders them somewhat open to suspicion, due to the fact that there are always numerous opportunities for the contamination of ground water by leachings from cesspools, privy vaults and leaky sewers.

The results of the analyses of samples of the public supply and of the various other sources of supply made by the Division of Laboratories and Research will be found in the appended table. Of the two samples of water from the wells, one showed the presence of organisms of the B. coli type, although in a 30 c. c. volume only. The analytical results also show very small amounts of nitrogen in its various forms and even as nitrates, although the chlorine content is above normal for this region. This high chlorine probably indicates the occurrence of a certain amount of contamination of animal or human wastes in the ground water supply tributary to the wells. The other results however indicate that such contamination had been well oxidized or purified by passage through the soil.

The analyses of the regular supply show a clear and comparatively soft water, although at times somewhat colored. Decomposing and decomposable organic matter is present in moderate amounts and the results are consistent with the conditions upon the watershed and the opportunities for a certain amount of organic contamination. The single set of analyses of both raw and filtered water show that, although the filter was apparently removing some color and turbidity, it was not efficient in removing bacteria and especially B. coli. Another point of significance is that the alkalinity of the filtered water is the same as that of the raw water. The action of alum upon water is such that the alkalinity is reduced, and the fact that it has not been reduced is evidence that no alum was being applied to the raw water at

the time of the inspection. Sulphate of aluminum when applied to natural water containing alkalinity or carbonate of lime, will react with this alkalinity forming a precipitate of aluminum hydrate. This precipitate occurs in the form of flakes which entangle particles of dirt and bacteria in the raw water. Without the aid of the coagulant these dirt particles and bacteria would pass through the filter to a considerable extent, but when the precipitate is produced entangling the foreign matter the whole is strained out by the filter.

In view of the above facts, the following conclusions may be drawn:

1. That the watersheds of both the Yaleville and Newton creeks are in such condition as to furnish supplies of reasonably good physical quality, although, owing to the numerous opportunities for accidental and intermittent contamination, the supplies derived from these sources are not safe for domestic consumption without adequate purification.
2. That the filter plant for the Yaleville Creek supply is open to objection in view of the unsatisfactory and unreliable method of applying the alum and the failure of this method to insure the application of proper amounts of coagulant at all times.
3. That the location of the wells of the sugar factory is such as to render them open to some suspicion, due to the possibility of contamination of the ground water sources.
4. That the necessity of auxiliary supplies would be largely if not entirely eliminated by the proper development and conservation of the Yaleville Creek supply.

I would therefore recommend:

1. That the board of water commissioners make regular and frequent inspection of the watersheds tributary to the public supply of their village in order to detect and remove any direct sources of contamination which may occur.
2. That the board of water commissioners apply to this Department for the enactment of rules and regulations for the sanitary protection of their watersheds in case they have any difficulty in removing sources of contamination.
3. That the water commissioners improve the operation of the filter plant by adjusting the application of alum so that the raw water receives at all times an adequate amount of coagulant.
4. That owing to their unsatisfactory location and the strong possibility for their contamination the wells at the sugar factory be abandoned as an auxiliary source of supply.
5. That regular analyses be made of both the raw and filtered water of the Yaleville Creek supply in order to control the operation of the filter plant.
6. That the village authorities consider ways and means for a more adequate development of the Yaleville Creek supply, and in this connection should secure the advice of a competent engineer relative to the best method for such development.
7. That in view of the lower bacterial efficiency of pressure filters compared with other more satisfactory types the village supplement the filtration of the Yaleville Creek supply by sterilization with liquid chlorine.
8. That in case the Newton creek is retained as an auxiliary supply it should also be subjected to sterilization.

In view of the obvious lack of efficient operation of the plant as above pointed out, and to the prime importance of this feature as affecting the safety of the water supply, it is suggested that the village follow out the plan which is now being quite generally adopted by the more progressive water works managements in this State, of engaging the services of a competent consulting expert to make occasional visits to the plant during the year to study the local conditions and operation of the filters and give detailed advice as to the best methods to employ to improve the operation of the plant and maintain it at its highest efficiency.

Respectfully submitted,

THEODORE HORTON,
Chief Engineer

ALBANY, N. Y., *September* 7, 1915

RESULTS OF WATER ANALYSES

Abbreviations used to describe odors of water: 0, none; 1, very faint; 2, faint; 3, distinct; 4, decided; 5, strong; 6, very strong; a, aromatic; d, disagreeable; e, earthy; f, fishy; g, grassy; m, musty; v, vegetable

Municipality	County	Source of sample	Date of collection	PHYSICAL				CHEMICAL (PARTS PER MILLION)											BACTERIOLOGICAL			
						ODOR		SOLIDS			NITROGEN AS—						HARDNESS			B. COLI TYPE + = PRESENT — = ABSENT		
				Color	Turbidity	Cold	Hot	Total	Loss on ignition	Mineral residue	Free ammonia	Albuminoid ammonia	Nitrites	Nitrates	Oxygen consumed	Chlorine	Total	Alkalinity	Bacteria per c.c.; gelatin 20°; 48 hours	10 c.c.	1 c.c.	1-10 c.c.
Bainbridge....	Chenango.....	Tap, public supply.........	3/ 5/08	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	400	—	+	....
Bainbridge....	Chenango.....	Tap, public supply.........	11/13/08	3	Tr.	....	....	42	....	....	.008	.040	.001	0.40	0.95	2.37	15.6	13.0	200	+	+	+
Bainbridge....	Chenango.....	Tap, public supply.........	1/13/09	10	1	....	....	43	16	27	.008	.114	.001	0.24	3.10	1.25	14.3	4.0	1,000	+	+	—
Bainbridge....	Chenango.....	Tap, public supply.........	7/21/10	1	Tr.	....	....	58	12	46	.004	.052	Tr.	Tr.	0.60	0.37	31.2	35.5	300	—	—	—
Bainbridge....	Chenango.....	Tap, public supply.........	11/ 2/10	Tr.	Cl.	....	....	41	10	31	.328	.024	.001	0.20	0.10	1.75	18.2	12.0	160	—	—	—
Bainbridge....	Chenango.....	Tap, public supply.........	1/17/11	5	Tr.	....	....	46	18	28	.176	.090	.005	0.40	1.20	1.25	20.8	11.0	80	+	—	—
Bainbridge....	Chenango.....	Tap, public supply.........	4/ 1/11	Tr.	2	....	....	34	11	23	.006	.032	.001	1.00	2.20	1.75	19.5	17.0	400	+	—	—
Bainbridge....	Chenango.....	Tap, public supply.........	6/14/11	25	Tr.	....	....	52	24	28	.010	.014	.001	0.02	6.00	0.75	22.1	18.0	4,000	+	+	+
Bainbridge.....	Chenango.....	Tap, public supply.........	7/10/11	Tr.	Cl.	....	....	36	11	25	.016	.038	Tr.	Tr.	1.80	1.25	22.1	19.0	350	+	—	—
Bainbridge....	Chenango.....	Tap, public supply.........	10/31/11	5	Cl.	....	....	39	11	28	.020	.054	.002	0.30	2.00	1.25	26.0	16.0	160	+	—	—
Bainbridge....	Chenango.....	Tap, public supply.........	1/30/12	Tr.	Cl.	....	....	36	13	23	.022	.048	Tr.	0.60	0.30	1.12	22.1	11.0	70	+	+	—
Bainbridge....	Chenango.....	Tap, public supply.........	4/13/12	10	Tr.	....	....	42	13	29	.096	.044	.001	0.26	1.70	0.75	15.6	6.0	20	+	—	—
Bainbridge....	Chenango.....	Tap, public supply.........	9/11/12	Tr.	Cl.	....	....	59	20	39	.002	.022	Tr.	0.30	0.60	1.25	26.0	19.0	50	+	—	—
Bainbridge....	Chenango.....	Tap, public supply.........	10/25/12	15	10	....	....	57	16	41	.008	.166	Tr.	0.24	6.20	0.75	20.2	10.0	3,700	+	+	+
Bainbridge....	Chenango.....	Tap, public supply.........	12/ 6/12	15	Tr.	....	....	34	11	23	.048	.068	Tr.	0.40	3.10	0.87	20.8	7.0	950	+	+	—
Bainbridge....	Chenango.....	Tap, public supply.........	2/ 8/13	Tr.	Cl.	....	....	31	....	....	.032	.032	Tr.	0.50	1.00	1.00	19.5	10.0	190	+	—	—
Bainbridge....	Chenango.....	Tap, public supply.........	3/18/13	3	Tr.	....	....	34	....	....	.060	.054	Tr.	0.34	2.30	1.12	15.6	6.0	170	—	—	—
Bainbridge....	Chenango.....	Tap, public supply.........	4/22/13	Tr.	Cl.	....	....	29	....	....	.028	.036	.001	0.34	1.00	1.00	18.2	10.0	220	—	—	—
Bainbridge....	Chenango.....	Tap, public supply.........	6/ 3/13	10	Tr.	....	....	35	....	....	.004	.036	Tr.	0.26	2.30	0.50	18.2	13.0	180	+	+	+
Bainbridge....	Chenango.....	Tap, public supply.........	7/25/13	Tr.	Cl.	....	....	109	....	....	.002	.004	.001	0.80	0.20	4.00	74.3	73.0	40	+	—	—
Bainbridge....	Chenango.....	Tap, public supply.........	4/ 2/14	10	1	1 v.	1 v.	26	10	16	.020	.096	Tr.	0.36	3.20	1.00	14.3	5.0	450	2+1—	0+3—	0+3—
Bainbridge....	Chenango.....	Raw water, Yaleville Creek..	5/30/15	1	3	2 v.	2 v.	53	14	40	.002	.014	Tr.	0.30	0.40	1.25	23.4	20.0	160	3+0—	0+3—	0+3—
Bainbridge....	Chenango.....	Filtered water, tap.........	6/30/15	Tr.	Tr.	2 v.	2 v.	54	10	44	.002	.008	Tr.	0.30	0.40	1.25	23.4	20.0	40	3+0—	0+3—	0+3—
Bainbridge....	Chenango.....	Newton Creek supply........	6/30/15	....	....	....	....	....	....	....	....	....	....	0.06	....	....	....	....	40	3+0—	0+3—	0+3—
Bainbridge....	Chenango.....	Sugar factory well..........	6/30/15	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	30	1+2—	0+3—	0+3—
Bainbridge....	Chenango.....	Sugar factory well..........	7/19/15	Tr.	Cl.	1 v.	1 v.	123	15	108	.004	.008	Tr.	0.02	0.20	4.50	75.7	75.0	25	0+3—	0+3—	0+3—

BALDWIN

HERMANN M. BIGGS, M.D., *State Commissioner of Health:*

An investigation of the public water supply of Baldwin, L. I., was made on October 1, 1915, by Mr. C. M. Baker, assistant engineer.

Baldwin is an unincorporated village located in the town of Hempstead, Nassau county, on the Montauk branch of the Long Island R. R. about 24 miles from New York City. The estimated population of the village is 3,000.

The water supply is owned and controlled by the Baldwin Water Company. The plant, consisting of wells, pumping station and standpipe, is located near Millburn creek about ½ mile north of the village. There is a total of some 370 service taps, only 12 of which are metered. About 50 per cent. of the population are served with the water. The water consumption during the summer is approximately 150,000 gallons daily with a maximum of perhaps 200,000, and during the winter 100,000 daily. The pressure ranges from 68 to 78 pounds per square inch.

The wells consist of two 4½ inch and four 6 inch wells 28½ feet deep with water rising in them to within about 4 feet of the surface. Copper strainers are provided for the lower ends of the suction pipes, those for the 4½ inch wells being 8 feet long and for the 6 inch wells 12 feet long. The pumping equipment consists of two Gould pumps each with a capacity of 250 gallons per minute. They are driven by two 25 H. P. gasoline engines. From the wells the water is pumped into an elevated steel tank located on a tower near the plant. The tank is 130 feet high and has a capacity of 110,000 gallons. From the tank the water is distributed by gravity through 30 miles of cast iron pipe ranging in size from 4 to 12 inches in diameter.

The water company owns between 4 and 5 acres of land in the vicinity of the plant. The residence of the engineer in charge of the plant is located on this plot. Two cesspools, constructed of brick and concrete masonry are provided for disposing of the sewage from the house. These cesspools are about 175 feet from the wells. The wells are located about 4 feet from the eastern boundary of the land belonging to the water company and while there are at present no improvements on this adjoining property, it is possible that buildings may be constructed there in the future. The only other house in the vicinity of the plant is a residence located about 300 feet west of the plant.

Although samples of water were not collected at the time of the inspection they were later collected by Dr. H. Phipps, acting health officer and sent to the Division of Laboratories and Research for analysis, the results of which are as follows:

REPORT OF WATER ANALYSIS FOR BALDWIN

Source		Tap, near center of village	Pumping station
Collected on		10/21/15	....
Color		....	Trace
Odor, hot		....	1 v
Odor, cold		....	1 v
Turbidity		....	Clear
Solids, total		....	80
Loss on ignition		....	15
Mineral residue		....	65
Ammonia, free		....	.016
Ammonia, albuminoid		....	.004
Nitrites		....	.002
Nitrates		....	1.60
Oxygen, consumed		....	2.60
Chlorine		....	8.50
Hardness, total		....	55.70
Alkalinity		....	8.00
Bacteria per c.c		20	120
B. coli type	10 c.c.	0+3—	2+1—
	1 c. c.	0+3—	0+3—
	1/10 c.c.	0+3—	0+3—

Results are expressed in parts per million. + Present. — Absent.

Abbreviations used to describe odors of water: 0, none; 1, very faint; 2, faint; 3, distinct; 4, decided; 5, strong; 6, very strong; a, aromatic; d, disagreeable; e, earthy; f, fishy; g, grassy; m, musty; v, vegetable.

The results of the analysis show that the water was satisfactory in appearance at the time the samples were collected and that there was only a moderate amount of organic matter present as indicated by the figures for free and albuminoid ammonia, nitrites and nitrates. The figure for chlorine is apparently above normal for the locality. The bacterial count was low in the sample collected from a tap in the village and moderate in the sample collected at the pumping station. Colon bacilli were found in two of the 10 c. c. inoculations of the sample collected at the pumping station thus indicating the presence of some active contamination, and although the cesspools described above are about 175 feet from the wells, it is probable that they are the source of this contamination.

As a result of this investigation it is evident that the water supply of Baldwin is derived from ground water sources subject to some pollution probably due to leaks in the cesspools at the residence of the engineer. It is also apparent that the company owns insufficient land in the vicinity of the wells to adequately protect the supply from pollution provided other buildings are constructed in the vicinity.

In view of the above I beg to offer the following recommendations:

1. That the cesspools which receive the sewage from the engineer's residence be abandoned and new cesspools constructed at a greater distance from the wells or that metal containers be provided in their stead, or that the present cesspools be made absolutely watertight.

2. That the company purchase more land in the vicinity of the plant, particularly to the east in order that it may readily and effectually control the sanitary conditions in the vicinity and thus protect the supply from pollution.

3. That analyses of the water be occasionally made during the year to detect the presence of any active contamination which may occur.

4. That, should such pollution at any time be found present, steps be immediately taken:

(a) To determine and eliminate the source of pollution if possible or
(b) Provide adequate sterilization of the supply.

Respectfully submitted,

THEODORE HORTON,
Chief Engineer

ALBANY, N. Y., *December 29, 1915*

BATAVIA

HERMANN M. BIGGS, M. D., *State Commissioner of Health:*

A reinspection of the public water supply of Batavia was made on April 1, 1915, by Dr. C. V. Patchin sanitary supervisor of District "L" and the following facts in respect to the present sanitary condition of this supply are based largely upon information furnished by him. A report on a previous inspection of this supply made by Professor H. N. Ogden in connection with his investigation of the general sanitary condition of this municipality will be found on page 876 of the thirty-third annual report of this Department.

The source of water supply, Tonawanda creek, and the water works system in general remain practically the same as described in the previous report. The water works intake is located near the center of the village and the water is pumped directly into the distributing system without purification. The decidedly unsatisfactory sanitary and esthetic quality of this supply is recognized by the people of the community and it is claimed that practically no one uses the public water supply for drinking purposes, drinking water being obtained from the numerous private wells which exist throughout the city. The water works are owned and operated by the city and it is understood that steps are being taken toward the improvement of the supply

either by the installation of a filtration plant or a chlorine apparatus or by securing a new supply from some other adequate and satisfactory source. A firm of consulting engineers has been retained by the city to report upon the best method of obtaining a satisfactory water supply.

The watershed of Tonawanda creek and its tributaries above Batavia is approximately 190 square miles in area. Upon this area there are several villages and hamlets and the total population may be roughly estimated at 8,000 or about 40 per square mile. The opportunities for direct and indirect contamination of this supply are very numerous, not only from the resident population on the watershed above the city but from the population within the limits of the city itself. Although none of the villages upon this watershed have complete sewer systems draining directly into the stream the large resident population on the watershed renders serious contamination practically unavoidable.

The unsatisfactory quality of this public water supply was clearly pointed out in the earlier report as was also the potential danger to health from the wide spread practice of obtaining drinking water of doubtful sanitary quality from the numerous wells scattered throughout the city. It was therefore recommended that the Board of Water Commissioners take steps to provide a satisfactory water supply for the municipality which should be available for all domestic purposes.

From the report of Dr. Patchin it appears that the city has taken action toward carrying out this recommendation.

At the time of his inspection samples of water were collected by Dr. Patchin from the city supply and also from several wells in the city and the results of the analyses of these samples together with others made in the past by the Division of Laboratories and Research will be found in the appended table.

The results of the analyses of the water from the public supply show a water very turbid, high in color, and very hard. The total number of bacteria are always excessively high and organisms of the B. coli type usually present in samples as small as 1 c. c. and frequently in 1/10 c. c.

The analyses of the various well waters are too few in number and the information regarding the wells too meagre to draw definite conclusions regarding the sanitary quality of these well waters at all times and under all conditions. It may be said, however, that all wells in a thickly settled community, especially in a limestone region where crevices and channels exist in the underground strata, are almost sure to be actively contaminated at some time of other.

In view of the fact that a report is being prepared by consulting engineers upon the most feasible method of obtaining a satisfactory water supply for the city it seems to be unnecessary to make other recommendation at this time than that the city authorities be urged to continue their efforts towards procuring a safe and satisfactory water supply as soon as possible.

Respectfully submitted,

THEODORE HORTON,
Chief Engineer

ALBANY, N. Y., *May* 7, 1915

Results of Water Analyses

Abbreviations used to describe odors of water: 0, none; 1, very faint; 2, faint; 3, distinct; 4, decided; 5, strong; 6, very strong; a, aromatic; d, disagreeable; e, earthy; f, fishy; g, grassy; m, musty; v, vegetable

Municipality	County	Source of sample	Date of collection	Physical: Color	Physical: Turbidity	Physical: Odor: Cold	Physical: Odor: Hot	Chemical (Parts per Million): Solids: Total	Solids: Loss on ignition	Solids: Mineral residue	Nitrogen as — Free ammonia	Nitrogen as — Albuminoid ammonia	Nitrogen as — Nitrites	Nitrogen as — Nitrates	Oxygen consumed	Chlorine	Hardness: Total	Hardness: Alkalinity	Bacteriological: Bacteria per c.c.; gelatin 20°, 48 hours	B. Coli Type (+ = present, — = absent): 10 c.c.	B. Coli Type: 1 c.c.	B. Coli Type: 1-10 c.c.
Batavia	Genesee	Tap, public supply	9/27/13	10	5	....	....	255	25	230	.012	.082	.02	0.08	3.00	10.00	188.5	160.0	10,500	+	+	+
Batavia	Genesee	Tap, public supply	11/22/12	8	18	....	....	214	24	190	.014	.088	.001	0.10	2.60	4.25	165.8	139.0	24,000	+	+	
Batavia	Genesee	Tap, public supply	1/ 9/13	20	105	....	....	195	....	....	.040	.170	.007	1.40	6.20	2.87	70.0	58.0	77,000	+	+	
Batavia	Genesee	Tap, public supply	4/17/13	20	30	....	....	193	....	....	.034	.094	.001	0.50	2.80	3.50	148.6	119.0	8,600	+	+	
Batavia	Genesee	Tap, public supply	4/ 1/15	8	20	....	....	193	35	158	.002	.034	.015	0.60	4.30	4.50	142.8	118.0	400	3+1—	2+2—	3+1
Batavia	Genesee	Well, 108 Bank street	4/ 1/15	5	60	2 a.	3 a	541	45	496	6.24	0.150	.030	0.02	7.60	39.0	404.0	400.0	90	1+3—	0+4—	0+4—
Batavia	Genesee	Well, 27 Harvester street	4/ 1/15	....	....	....	....	....	....	....	....	....	....	....	....	70.0		....	100	0+4—	0+4—	0+4
Batavia	Genesee	Well, 12 Hutchins street	4/ 1/15	....	....	....	....	....	....	....	....	....	....	....	....	75.0	....	....	16,000	0+4—	0+4—	0+4

BAY SHORE (Great South Bay Water Co.)

HERMANN M. BIGGS, M.D., *State Commissioner of Health:*

An inspection of the water supplies furnished by the Great South Bay Water Company to the villages of Bay Shore, Islip, East Islip, Sayville, Bay Point, Blue Point and Patchogue was made by Mr. C. M. Baker, assistant engineer, on May 12, 1915.

These villages are located along the south shore of Long Island on the Montauk Branch of the L. I. R. R., Bayshore, the most westerly, being about forty-five miles and Patchogue the most easterly, fifty-six miles from New York City. The water mains of the company begin just east of the village of Babylon and extend continuously through to Patchogue, a distance of about sixteen miles. The populations of the villages served are as follows: Bay Shore, 4,000; Islip, 2,000; East Islip, 1,000; Sayville, 3,000; Bay Point, 1,500; Blue Point, 1,000, and Patchogue, 6,000, thus making a total population tributary to the water supply of about 18,500. The population, however, is somewhat greater during the summer due to the large number of summer residents from the city.

The water system consists of wells and pumping stations, located at both Bay Shore and Patchogue from which the water is pumped into standpipes whence it is distributed by gravity to the consumers. There is a total of 2,800 service taps which, allowing five persons per tap, indicates that there are about 14,000 consumers, or 75 per cent. of the total population. Approximately 750 of the services are metered. The water consumption from the Bay Shore plant is about 700,000 gallons daily during the winter and 1,000,000 to 1,200,000 gallons during the summer. At Patchogue the winter consumption is approximately 450,000 and the summer consumption 550,000 gallons daily. The total daily water consumption is thus approximately 1,150,000 gallons during the winter and 1,550,000 gallons during the summer. These figures correspond to per capita rates of 82 and 110 gallons per day respectively. As mentioned above the population varies somewhat during the summer and winter and this accounts to some extent for the much higher consumption during the summer months.

The plant at Bay Shore is located in the northwestern portion of the village. The wells consist of eighteen 5-inch and six 10-inch wells driven to a depth of 40 feet through a stratum of sand. Water is drawn from the wells and forced into the mains by two pumps each with a capacity of 2,000,000 gallons per day. Steam power is furnished by two 100-horse power boilers. At Patchogue there were eleven 10-inch wells in use at the time of the inspection and eight more were being constructed. These wells are about 50 feet deep and the stratum through which they pass is sand. The pumps at this plant consist of two Worthington pumps, one with a capacity of 2,000,000 gallons per day and the other 1,500,000. Power is furnished by steam from two boilers, one a 150-horse power and the other a 100-horse power. The suction lift on the pumps varies from 5 to 10 feet in each of the above plants. Standpipes with the capacities indicated, are placed as follows: At Bay Shore with a capacity of 252,000 gallons, at East Islip, 175,000, at Sayville 100,000 and at Patchogue 175,000, thus giving a total storage of 702,000 gallons. There is a total of 89 miles of water mains ranging in size from 2 to 12 inches in diameter, the main lines being in all cases 10 and 12-inch pipe.

The density of population within a radius of one-quarter of a mile of the Bay Shore plant is approximately 750 people per square mile and within one-half mile of the plant 650 per square mile. Outside of this area and within the limits of the probable area of influence the population is about 40 per square mile. The plant is located in the center of a plot of land about 300 by 600 feet. The wells are distributed to the north and south of the plant and in no case are they closer than 100 feet to adjoining property. A cottage is provided at the pumping plant for the engineer. A privy at the plant is provided with metal pails which are, so far as could be learned, properly cared for. It would thus seem that the supply is fairly well protected from sources of contamination in the immediate vicinity of the wells.

Within a radius of one-quarter of a mile of the plant at Patchogue the density of population is approximately 1,475 per square mile and within a radius of one half mile. 1,330. Outside of this area the population is approximately 50 per square mile. It is evident from these figures that the wells are located near the center of a comparatively dense population. The privy at the power plant is not provided with a watertight container and was in a very insanitary condition at the time of the inspection. It is located about 50 feet from the wells. About 200 feet distant from the wells and up the slope is a row of some eight or ten houses which were provided with privies that are in nearly all cases provided with earth vaults only. It is thus evident that there are numerous sources of pollution in the vicinity of the wells which may cause active and dangerous contamination of the supply, especially in view of the fact that the topography in the vicinity is such that the flow of the ground water is doubtless from the sources of pollution toward the wells.

Samples of water were collected at each pumping station and sent to the Division of Laboratories and Research for analysis. The results of these analyses are given in the appended table.

The analyses of the Bay Shore supply indicate a satisfactory quality of water from a chemical standpoint, but the bacterial content, 550 per c. c. is very high for a well water. This however, is doubtless due to the delay in transit, two days elapsing from the time of collecting the sample until the analysis was made. No colon bacillus was found present. It is thus apparent both from the analysis and conditions surrounding the wells that this supply was in a satisfactory condition at the time of the inspection.

The results of the chemical analysis of the Patchogue supply indicate in general a satisfactory quality but the bacterial analysis of this supply shows the presence of 90 bacteria per c. c. with organisms of the B. coli type present, thus indicating active contamination. It is thus evident from these analyses and also from a study of the conditions surrounding the wells at Patchogue, that active contamination was present in the water and the conditions surrounding the wells indicate that this pollution will probably continue until the immediate sources of pollution are removed.

Although the purifying effect of the sand strata through which the ground water passes is evidently considerable in the vicinity of both of these supplies, it is apparent that it is insufficient to remove all the contamination from the ground water supplying the Patchogue wells. In fact it is quite possible that at certain seasons of the year when the ground water flow is at a maximum or when the draft on the wells is at its greatest, the pollution may become more pronounced in the Patchogue supply and possibly at times even cause active contamination of the Bay Shore supply.

In order to remove these sources of pollution and thus protect the water supply from contamination some sanitary method of disposal should be provided for all sewage in the vicinity of the wells. Analyses of the water from both supplies should also be frequently made to determine the presence of any active contamination which may occur, since in this way only can it be determined whether the future improvement of conditions in the vicinity of the wells at Patchogue has sufficiently removed the source of pollution, to improve the water so that it is of a satisfactory quality. Should the improvement not bring about the desired results other steps could then be taken to safeguard the supply.

As a result of this investigation it is apparent that the water supplied by the Great South Bay Water Company from their Bay Shore plant was of a satisfactory quality at the time of the inspection and that the general conditions surrounding the plant were reasonably satisfactory. The water from the Patchogue plant, however, showed active contamination and the conditions surrounding the plant were unsatisfactory.

In view of these facts, I beg to recommend as follows:

1. That the company have watertight containers provided for all privies and all cesspools made watertight within a radius of 500 feet of the wells of both plants where such provision is not already made, and that these containers be properly cleaned and cared for.

2. That analyses be occasionally made of the water from both of the plants during the year to determine the presence of any active contamination which may occur.

3. That should the analyses show active contamination in the Patchogue supply after these improvements are made, or should active contamination be found present at any time in the Bay Shore supply steps be taken to eliminate by:

(a) Determining and eliminating, if possible, the sources of pollution or:

(b) Purifying the present supply by some satisfactory method of sterilizing it with liquid chlorine.

(c) Should the above improvements prove inefficient in rendering the supply satisfactory new wells or other supply, free from pollution, be developed.

A sewerage system properly designed and constructed for collecting and disposing of the sewage from the village, especially in the vicinity of the wells, and the subsequent elimination of all cesspools and privies in this locality, would undoubtedly be the most satisfactory method of improving and protecting the present water supplies, not only because of eliminating the more direct sources of pollution but also because of reducing the accumulation of pollution which invariably occurs in densely populated districts. It therefore seems advisable that the water company and village officials consider the construction of such systems at an early date.

Respectfully submitted,

THEODORE HORTON,
Chief Engineer

ALBANY, N. Y., *June* 19, 1915

REPORT OF WATER ANALYSIS FOR BAY SHORE AND PATCHOGUE

Source		Bay Shore	Patchogue
Collected on		5/12/15	5/12/15
Color		Trace	Trace
Odor, hot		1 v	1 v
Odor, cold		1 v	1 v
Turbidity		Clear	Clear
Solids, total		39	27
Loss on ignition		4	6
Mineral residue		35	21
Ammonia, free		.010	.004
Ammonia, albuminoid		.006	.002
Nitrites		.001	Trace
Nitrates		0.60	0.10
Oxygen consumed		0.20	0.50
Chlorine		5.75	5.25
Hardness, total		11.10	14.30
Alkalinity		0.30	8.00
Iron		0.10	....
Bacteria per c.c		550*	90
B. coli type	10 c.c.	0+3—	2+1—
	1 c.c.	0+3—	0+3—
	1/10 c.c.	0+3—	0+3—

Results are expressed in parts per million: + Present. — Absent.

Abbreviations used to describe odors of water: 0, none; 1, very faint; 2, faint; 3, distinct; 4, decided; 5, strong; 6, very strong; a, aromatic; d, disagreeable; e, earthy; f, fishy; g, grassy; m musty; v, vegetable.

* Two days in transit.

BELMONT

HERMANN M. BIGGS, M.D., *State Commissioner of Health:*

An investigation of the public water supply of the village of Belmont was made by Mr. C. M. Baker, assistant engineer, on August 11, 1915. Mr. Baker was accompanied and assisted in the investigation by Dr. John A. Conway, sanitary supervisor.

Belmont is an incorporated village located on the Erie R. R. in the town of Amity, Allegany county, about 34 miles west of the city of Hornell. The present population of the village is about 1,000. The water supply is owned by the municipality and the water is derived from two sources, namely, springs and the north branch of Phillips creek, a small stream northwest of the village. A small dam has been constructed across the creek forming a small basin about three miles from the village. From this basin the water is conveyed by gravity to the village mains, the overflow going to a reservoir located on a hill above the village. The springs are connected with the main leading from the creek to the village but since the springs are at a somewhat lower elevation than the creek intake, the supply is derived almost entirely from the creek except when the source becomes inadequate, as it was stated, is sometimes the case. About 900 or 90 per cent. of the inhabitants are served with the water. Since no meters are provided and as there is no other adequate method of determining the water consumption, no definite idea could be obtained regarding the consumption. The pressure in the village is about 75 pounds per square inch.

The reservoir which receives the overflow is located on a hill above the village but at the time of the investigation there was no water in it due, so the assistant engineer was informed, to an obstruction or break in the water main from the creek intake to the village. The reservoir is constructed of concrete and is not covered. There is a total of about six miles of water mains ranging in size from two to eight inches in diameter, the majority of them, however, being constructed of 4 and 6 inch pipe.

The springs, three in number, are located along the south side of the valley of Phillips creek. They are practically all located in pasture land and are subject to pollution from stock in their immediate vicinity. They are stoned up and covered with a small house but are not adequately protected by fences or drainage ditches.

The north branch of the Phillips creek rises 5 or 6 miles northwest of the village of Belmont and flows in a southerly direction to Phillips creek which, in turn, discharges into the Genesee river. The creek is fed principally by a number of springs during the dry season. The land is hilly and the geological formation consists principally of sand stone and shale. Probably 50 per cent. of the area is wooded. In the immediate vicinity and adjacent to the creek the land is used for pasturage, there being a total of 125 to 150 head of stock on the watershed which have direct access to the creek.

There are some 12 or 13 farms on the shed which normally corresponds to a population of about 60 people. The area of the water shed is about 2 square miles and the corresponding population per square mile is thus about 30. A number of farms on the watershed are located comparatively close to the watercourse and there is thus possibility for direct contamination of the water supply. The buildings of one farm located about one-half mile above the intake, are about 150 feet from the stream. The privy at this place, however, is provided with a tight concrete vault but no such provision is made at any of the other farms on the watershed. The most serious condition in connection with the contamination of the water supply was at the farm located near the source of the stream. At this place one privy, equipped with only an earth vault, was located about 50 feet from the stream and another about 75 feet distant. A pig pen, which was in a very insanitary condition was located practically on the bank of the stream only a few feet from the water course. Several years ago a case of typhoid developed at this farm and it was probably only through the prompt action of the village in providing a trained nurse to be present at the farm to look

after the proper disposal of the excreta that typhoid fever was prevented in the village. No water rules have been enacted protecting this watershed.

Samples of water were collected from Phillips creek and the various springs at the time of the inspection and sent to the Division of Laboratories and Research for analyses, the results of which, together with those of previous analyses, are recorded in the appended table.

The results of the analyses of water taken from taps in the village show a high turbidity at times, also the presence of considerable organic matter indicated by the figures for free and albuminoid ammonia and nitrates. The chlorine content is also considerably above normal. Bacteria are present in quantities ranging from 10 to 2,500 per c. c. The B. coli type are practically always present in the 10 c. c. samples, frequently in the 1 c. c. samples and occasionally in the 1/10 c. c. samples, thus indicating active contamination. The analyses of the creek water show results similar to those of the samples collected from the taps and thus indicate that the larger proportion of the village supply is being obtained from the creek. Bacteria were present in rather large numbers in both of the spring supplies from which samples were collected, and the B. coli type were found present in both the 10 and 1 cubic centimeter inoculations. It is thus apparent that pollution is finding its way into the spring supplies, probably because of the inadequate protection provided against surface wash.

As a result of this investigation, I would conclude:

1. That the water supply obtained by the village of Belmont from the north branch of Phillips creek, and which constitutes the greater proportion of the supply, is not of a satisfactory sanitary quality for domestic purposes, due to the opportunities for both direct and indirect contamination.

2. That the various springs, although showing some contamination at the time of the inspection could be made to furnish a satisfactory quality of water by adequately protecting them from surface wash and pollution by cattle.

3. That the quantity of water to be derived from the present springs supply is insufficient for the needs of the village.

4. That, with proper conservation, a sufficient supply can be derived from the north branch of Phillips creek.

In view of the above it is apparent that the sanitary quality of the public water supply of the village of Belmont should be improved and I, therefore, offer the following recommendations to be acted upon by the village authorities:

1. That the quality of the present supply be improved by:

(a) Removing all source of direct contamination upon the Phillips creek watershed. In case any difficulty is experienced in this respect, application should be made to this Department for the enactment of rules and regulations for the sanitary protection of the watershed.

(b) Providing adequate purification of the creek supply.

(c) Abandoning the present spring supply or adequately protecting the various springs from contamination by the construction of suitable fences and drainage ditches.

2. In lieu of the above a new supply might be provided by developing additional springs or wells, properly located and protected from contamination.

Respectfully submitted,

THEODORE HORTON,
Chief Engineer

ALBANY, N. Y., *September* 28, 1915

RESULTS OF WATER ANALYSES

Abbreviations used to describe odors of water: 0, none; 1, very faint; 2, faint; 3, distinct; 4, decided; 5, strong; 6, very strong; a, aromatic; d, disagreeable; e, earthy; f, fishy; g, grassy; m, musty; v, vegetable

Municipality	County	Source of sample	Date of collection	Physical: Color	Physical: Turbidity	Physical: Odor, Cold	Physical: Odor, Hot	Chemical (Parts per Million): Solids, Total	Solids, Loss on ignition	Solids, Mineral residue	Nitrogen as—Free ammonia	Nitrogen as—Albuminoid ammonia	Nitrogen as—Nitrites	Nitrogen as—Nitrates	Oxygen consumed	Chlorine	Hardness, Total	Hardness, Alkalinity	Bacteriological: Bacteria per c.c. 20° C.	B. coli type present + absent —: 10 c.c.	1 c.c.	0.1 c.c.
Belmont	Allegany	Tap, public supply	5/21/10																100	—		
Belmont	Allegany	Tap, public supply	1/31/11	40	60			70	26	44	.004	.220	.001	0.40	6.90	2.00	26.0	20.0	1,400	—	—	—
Belmont	Allegany	Tap, public supply	4/20/11	10	5			45	12	33	.018	.052	.001	0.90	1.40	2.25	41.2	22.0	160	—	—	
Belmont	Allegany	Tap, public supply	6/10/11	15	Tr.			85	19	66	.010	.036	Tr.	0.90	2.60	1.00	62.9	60.0	60	—	—	
Belmont	Allegany	Tap, public supply	9/22/11	5	Cl.			110	21	89	.016	.042	Tr.	0.80	2.00	1.25	75.7	71.4	10	—	—	
Belmont	Allegany	Tap, public supply	11/27/11	18	5			63	14	49	.020	.106	.001	0.10	5.00	1.50	52.5	28.0	1,800	+	+	
Belmont	Allegany	Tap, public supply	1/20/12	14	10			109	30	79	.134	.170	.002	0.30	5.70	2.00	51.4	55.0	9,000	+	+	—
Belmont	Allegany	Tap, public supply	2/24/12	25	50			94	20	74	.066	.134	.001	0.10	5.00	2.63	48.6	48.0	17,000	+	+	—
Belmont	Allegany	Tap, public supply	4/12/12	15	15			63	21	42	.014	.010	.001	0.40	3.80	1.25	26.0	15.0	300	+	+	
Belmont	Allegany	Tap, public supply	1/13/13	25	5			58			.016	.090	Tr.	0.40	3.80	1.25	23.0	19.0	7,500	+	+	
Belmont	Allegany	Tap, public supply	3/8/13	10	Tr.			85			.010	.036	.001	0.50	1.00	1.50	82.7	46.0	1,400	+	+	
Belmont	Allegany	Tap, public supply	4/19/13	15	2			82			.015	.074	Tr.	0.40	3.20	1.25	51.6	41.0	1,800	+		
Belmont	Allegany	Tap, public supply	6/7/13	7	Cl.			111			.004	.036	Tr.	0.30	1.60	1.75	77.1	76.0	26,000	+	+	
Belmont	Allegany	Tap, public supply	10/5/13	20	5			70	17	53	.014	.106	Tr.	0.10	2.60	0.75	41.6	32.0	6,200	+	+	
Belmont	Allegany	Tap, public supply	11/22/13	15	Tr.			94	41	53	.016	.062	Tr.	0.14	2.70	1.00	49.9	35.0	[illegible]	+	+	
Belmont	Allegany	Tap, public supply	8/11/15																14,500	3+0	2+1	0+1
Belmont	Allegany	Phillips creek, north branch	5/21/10	Cl.	Tr.			81	25	56	.018	.046	.005	0.20	1.00	1.25	52.9	48.5	4,000	+		
Belmont	Allegany	Phillips creek, north branch	8/11/15	10	2	2 v	2 v	107	40	67	.026	.122	.002	0.60	9.20	2.25	51.4	44.0	20,500	3+0	3+0	2+1
Belmont	Allegany	Dam	4/20/12																300	+	+	+
Belmont	Allegany	Reservoir	4/20/12																200			
Belmont	Allegany	Whitcomb spring	8/11/15																3,200	1+2	1+2	0+1
Belmont	Allegany	Baker spring	8/11/15	Tr.	Cl.	1 v.	1 v.	107	5	102	.024	.016	.001	1.00	0.40	1.75	80.8	78.0	800	3+0	1+2	0+1

BLOOMVILLE

HERMANN M. BIGGS, M.D., *State Commissioner of Health:*

An investigation of the public water supply of the village of Bloomville was made on August 2, 1915, by Mr. Morton F. Sanborn, assistant engineer. The inspector was assisted at the time of the inspection by Mr. Edward W. Simmons, superintendent of the water company, and Dr. W. S. Dart, health officer of the town of Kortright.

Bloomville is an unincorporated village located in the southern part of the town of Kortright on the Ulster and Delaware railroad. It is near the northern part of Delaware county and about 15 miles southeast of the city of Oneonta. The population as estimated at the time of the inspection was about 400.

The water supply is owned by the Bloomville Water Company and the water works were designed by Mr. E. W. Moxley, civil engineer. The works were constructed by J. Vaughn of Stamford in 1895 under the direction of Mr. Moxley.

The supply is obtained from two springs located about three-quarters of a mile northeast of the center of the village on the north side of a hill. The water from these springs is collected in a covered distributing reservoir and thence flows to the distributing system by gravity, the average pressure in the village being about 100 pounds per square inch. There are about 2 miles of water mains, 4 inches in diameter. Fire protection is provided by hydrants placed in various parts of the village. There are about 80 houses in the water district, of which about 53 are served by this water supply, and all of these are metered. About 280 of the inhabitants, which corresponds to about 70 per cent of the total population, are served by this water system.

The approximate daily consumption is about 8,000 gallons, which would correspond to about 30 gallons per capita. These figures were obtained from the superintendent and are based upon the consumption as recorded by the meters.

There are no sewers or methods of sewage disposal in the village other than by local cesspools and privies.

The springs are about 500 feet apart. The northerly spring is located under a large rock and several trees in the vicinity form a sort of natural protection, although it is possible that a small amount of pollution may be caused by cows which pasture on the hillside. This spring is unprotected except by the natural barriers and a crude wooden fence. The southerly spring is in an open field and is covered with timber. This spring is located in a shallow well about 3 feet in diameter and 3 feet deep. Water from this spring first flows through an open basin, after which it flows to the distributing reservoir mentioned above.

The open basin has a barb wire fence surrounding it and is thus protected from the cattle. This basin ordinarily had a timber roof, but two years ago part of the roof fell through and the entire roof has since been removed. The sides of the basin are protected with riprap. Many frogs and water insects were noticed in the water. The reservoir is 20 feet by 22 feet in plan and about 5 feet deep and has a capacity of 8,750 gallons, which corresponds to a consumption of about one day.

The large reservoir is of stone masonry and is covered with a wooden roof. It is about 20 feet by 40 feet in plan and 8 feet deep and has a capacity of about 48,000 gallons, corresponding to about 6 days' storage. The water from the springs is fed to this reservoir and an overflow is provided to care for the surplus water. The reservoirs have not been cleaned in the last four years. The water mains are flushed out about three times a year.

The watershed above the spring is only about .03 of a square mile, although the area at the elevation of the spring from which the water might possibly drain to the springs may be estimated as one square mile. The soil is generally of sand and gravel although somewhat impervious to the passage of water. The rock formation under the soil consists chiefly of sandstone and shale.

There are no houses or buildings of any sort on the watershed above the springs, although the land is used for pasture, and it is possible that a small amount of pollution might be caused by the cattle.

At the time of the inspection samples of water were obtained from a tap in the village and the analyses of these samples will be found in the appended table.

From the results of these analyses it will be seen that the water at the time of the inspection had a trace of color, was practically clear and very soft. The amount of unoxidized and oxidized nitrogenous organic matter was comparatively small, as shown by the tests for ammonia and nitrates, although the oxygen consumed test showed a slight amount of carbonaceous organic matter. The total number of bacteria were somewhat high for an uncontaminated spring supply and organisms of the B. coli type were found in 1 c. c. The rather high bacterial count and the presence of B. coli indicate the presence of a small amount of pollution, evidently due to the drainage from the pasture.

As a result of this investigation and of the analyses, the following conclusions may be drawn:

1. That the spring supply of Bloomville if properly protected from surface wash and accidental contamination should afford a supply of satisfactory sanitary quality.

2. That the open condition of the upper reservoir and the condition of the riprap was such as to be a favorable breeding place for frogs and water insects, rendering the supply somewhat unsatisfactory from an esthetic standpoint.

3. That the pasturing of cattle on the land above and near the springs undoubtedly causes some pollution of the water from this source.

4. That the springs being open gives opportunity for pollution of an accidental or wilful nature by persons passing in the neighborhood and who may use the springs for drinking purposes.

In view of the above conclusions, I recommend that the water company take such steps as necessary to prevent pollution of the water, and would therefore recommend:

1. That the upper reservoir be cleaned and made watertight and that a cover be erected over the same.

2. That both springs be fenced off to prevent any possible contamination from animal or human sources and proper drainage ditches be provided to prevent surface wash entering the openings directly.

Respectfully submitted,
THEODORE HORTON,
Chief Engineer

ALBANY, N. Y., *September* 14, 1915

REPORT OF WATER ANALYSIS FOR BLOOMVILLE

Source		Tap
Collected on		8/2/15
Color		Trace
Odor, hot		1a
Odor, cold		1a
Turbidity		Clear
Solids, total		23
Loss on ignition		5
Mineral residue		18.
Ammonia, free		.052
Ammonia, albuminoid		.010
Nitrites		.001
Nitrates		0.30
Oxygen consumed		0.80
Chlorine		3.25
Hardness, total		16.9
Alkalinity		13.00
Bacteria per c.c.		275
B. coli type 10 c.c.	Inoculations	3+0—
B. coli type 1 c.c.	Inoculations	2+1—
B. coli type 1/10 c.c.	Inoculations	0+3—

Results are expressed in parts per million: + Present. — Absent.

Abbreviations used to describe odors of water: O, none; 1, very faint; 2, faint; 3, distinct; 4, decided; 5, strong; 6, very strong; a, aromatic; d, disagreeable; e, earthy; f, fishy; g, grassy; m, musty; v, vegetable.

BOVINA CENTER

HERMANN M. BIGGS, M.D., *State Commissioner of Health*:

An investigation of the public water supply of Bovina Center was made on August 31, 1915, by Mr. C. M. Baker, assistant engineer, assisted by Dr. C. C. Duryee, sanitary supervisor.

The unincorporated village of Bovina Center is located in the town of Bovina, Delaware county, 6 miles north of the village of Andes and about 12 miles southeast of the village of Delhi. It is located on the Little Delaware river. The village is reached by conveyance either from Bloomville on the Ulster & Delaware R. R.; from Andes on the Delaware & Northern R. R.; or from Delhi on the N. Y. O. & W. R. R. The present population is about 225.

Prior to the development of the present system the water supply had been derived from private wells of ordinary type except in a few instances where spring supplies were available. These wells provided practically no fire protection and their quality was in some cases questionable and it was, therefore, apparent that a satisfactory public water supply was much needed. As a result of this fact the Bovina Center Water Company, Inc., was organized with an authorized capital stock of $15,000. The present plan was constructed by this company in 1914 without application having been made to the Conservation Commission for the development of the supply as is required by law. Later, however, in 1915, the proper application was made to the Conservation Commission and the supply as then constructed was approved upon the following conditions:

> "1. The spillway section of the lower dam must be rebuilt or strengthened in such a manner as to render it safe. This work must be done in accordance with plans which have been previously submitted to and approved by this Commission and the work must be entirely completed before October 31, 1915.
>
> "2. All water which is allowed to enter the piping system of this company must be filtered to the satisfaction of this Commission except that during heavy fires it will be permitted that the filters be by-passed.
>
> "3. The Bovina Center Water Company, Inc., shall immediately initiate and carry through the proper measurements to obtain the enactment by the State Department of Health of rules and regulations for the sanitary protection of the watershed above the intake of the company on Coulter brook and thereafter the company shall rigorously enforce the provisions of these rules and regulations.
>
> "4. If, after the cleaning up and sanitary regulation of this water supply, analyses show that the quality of the filtered water is not satisfactory to this Commission, the company shall install apparatus for sterilizing the filter effluent by the use of liquid chlorine or otherwise or for the more adequate filtration thereof and thereafter shall sterilize or filter all water entering these pipes to the satisfaction of this Commission.
>
> "5. After these works have been constructed they shall be inspected by and be subject to the approval of this Commission as provided by section 523 of the Conservation Law."

The present supply is derived from Coulter brook at a point about 1¼ miles east of the center of the village. At this place two reservoirs are constructed from which the water is conveyed by gravity to the village. Practically all of the inhabitants of the village are served with the water. No meters are provided nor other means of determining the amount of water used and, therefore, no definite information could be obtained regarding the consumption. The pressure at the village varies from 40 to 70 pounds per square inch.

The upper reservoir which is caused by a dam constructed across Coulter brook, has a capacity of about 33,000 gallons and the lower reservoir constructed in a similar manner has a capacity of approximately 300,000

gallons. From the upper reservoir the water flows through a dry stone wall and 4 feet of gravel into a collecting gallery, whence it flows by gravity to the gate house at the lower reservoir about 225 feet distant. This gate house is provided with a 2-foot charcoal filter through which the water from the upper reservoir passes and then flows by gravity to the village. There is an intake from the lower reservoir into the well at the gate house which is provided with a check valve so arranged that when the supply from the upper reservoir is insufficient the valve will open and allow the water to enter from this lower reservoir first into the upper compartment of the well and thence through the charcoal filter to the village mains; if, however, the head of water on the filter becomes too great the water by-passes the filter and flows directly into the village system. Such a condition might exist during fire or at other times of excessive draught upon the supply.

The main leading from the reservoir to the village is constructed of 8-inch pipe and the mains within the village are 4 and 6 inches in diameter. The cost of the plant was about $16,000.

The watershed from which the water is derived is a mountainous country, a large portion of which is heavily wooded, the remainder being used for agricultural purposes. Practically all of the land adjacent to the stream is used for pasturage and the stock are allowed free access to the stream. The stream is fed principally by mountain springs during the dry seasons. The rock formation in the vicinity is principally shale and sand stone. A request has recently been made to this Department for the enactment of rules and regulations protecting the sanitary quality of the supply, in consequence of which a preliminary draft of rules and regulations has since been submitted to the Bovina Center Water Co.

There is a total of 11 houses and one school house on the watershed which corresponds to a population of about 55 people. The area of the watershed is 4.7 square miles, thus giving a population of approximately 12½ people per square mile. The location of these buildings, which in most cases are close to the stream, causes the source of the supply to be subject to considerable dangerous contamination. The following were the more serious cases of pollution:

1. Farm owned and occupied by Robert Robson, located about ½ mile above the intake. The privy, which is not provided with a vault, is located about 20 feet from a small stream flowing into Coulter brook at a point about 75 feet distant. The pig pen although not in use at the time of the inspection is 25 feet from this stream, the horse barn about 75 feet and the cow barn some 600 or 700 feet.

2. Farm owned and occupied by John Irving. Located ¾ mile above intake. The sewage from the house discharges through a tile drain into a small stream emptying into Coulter brook at a point about 1000 feet below. The house is about 250 feet from this stream; the barn 300 feet and the pig pen 75 feet.

3. Farm owned and occupied by Walter G. McDivitt. Located 1¼ miles above the intake. A privy which is not provided with a vault is located about 40 feet from a tributary to Coulter brook which, however, is dry during the majority of the year. The barn is about 150 feet distant.

4. School, 8 to 10 pupils, located 1 mile above intake. The privies, which are provided only with ordinary earth vaults, are located about 8 feet from the high water mark of the stream although they were about 75 feet from the water line at the time of the inspection.

5. Farm, owned and occupied by W. S. Thompson, located 1½ miles above the intake. The overflow from a large spring passes between the house and barn and flows into Coulter brook about 700 feet distant. The pig pen is about 20 feet from this stream. Conductors from the roof of the barn discharge into a manure pile and thence the water flows through a natural drain to the brook. A tile sewer from the house discharges into a pasture on quite level land about 250 feet from the brook. The sewage at the time of the inspection extended only about 20 feet beyond the outlet. Nevertheless, at certain seasons this sewage is probably carried to the brook by surface wash.

6. Farm, owned and occupied by Jennie B. Doig. The house is located 100 feet from the stream and the privy which is not provided with a vault, 150 feet.

7. Farm, owned by Miss Hanna Coulter and occupied by L. D. Jocelyn. The privy, which is not provided with a vault is located 10 feet from the stream, the hen house is practically on the stream and a small tributary through which water was flowing at the time of the inspection passes through the pig pen.

8. Farm, owned and occupied by Elmer Close. A privy of ordinary type is 150 feet distant and the pig pen 30 feet.

9. Farm, owned and occupied by F. P. Hunt. The brook passes between the house and barn with the barn and house each about 40 feet distant. The privy is located 20 feet from a small stream fed by a spring just back of the house.

10. Farm, owned and occupied by James D. Boyd. The house is located 15 or 20 feet from the stream; the barn about 200 feet, and the privy about 100 feet.

In addition to the above sources of almost direct contamination there are two other farms which are located between 700 and 800 feet from the stream.

Samples of the water were collected and sent to the Division of Laboratories and Research for analyses, the results of which, together with those of other previous analyses are as follows:

REPORT OF WATER ANALYSES FOR BOVINA CENTER

	GATE HOUSE			Stream ½ mile above intake	Stream above gravel filter	Tap	Public supply
Source	Lower compartment	Upper compartment	Upper compartment				
Collected on	12/21/14	12/21/14	2/10/15	2/10/15	2/10/15	8/31/15	9/1/15
Color	5	....	....	....	tr.	3	....
Odor, hot	2 v.	....	....	....	1 v.	1 v.	....
Odor, cold	2 v.	....	....	....	1 v.	1 v.	....
Turbidity	tr.	....	....	....	cl.	cl.	....
Solids, total	43	....	....	....	26	32	....
Loss on ignition	10	....	....	....	4	14	....
Mineral residue	33	....	....	....	22	18	....
Ammonia, free	.004	....	....	....	.016	.010	....
Ammonia, albuminoid	.018	....	....	....	.036	.054	....
Nitrites	tr.	....	....	....	.001	.001	....
Nitrates	0.60	....	....	....	0.60	.080	....
Oxygen consumed	1.30	....	....	....	1.50	0.80	....
Chlorine	1.38	....	....	....	1.00	2.00	....
Hardness, total	15.6	....	....	....	18.20	15.60	....
Alkalinity	5.00	....	....	....	1.00	13.00	....
Bacteria per c.c.	285,000	93,000	400	450	450	2,400	400
B. coli type 10 c.c.	+	+	+	+	+	3+0—	3+0—
B. coli type 1 c.c.	+	+	+	—	+	1+2—	2+1—
B. coli type 1/10 c.c.	+	—	—	—	—	1+2—	0+3—

Results are expressed in parts per million. + Present. — Absent.

Abbreviations used to describe odors of water: 0, none; 1, very faint; 2, faint; 3, distinct; 4, decided; 5, strong; 6, very strong; a, aromatic; d, disagreeable; e, earthy; f, fishy; g, grassy; m, musty; v, vegetable.

The results of these analyses indicate that the water was satisfactory regarding color, turbidity and odor at the time the samples were collected, also that it is quite soft. Regarding the sanitary quality, however, the analyses show the presence of considerable organic matter, and a rather high chlorine content, also a bacterial content which is at times very high and the presence of the B. coli type at all times in the 10 c. c. frequently in the 1 c. c. and occasionally in the 1/10 c. c. inoculations, thus proving conclusively that the water is actively and dangerously contaminated because of the insanitary conditions on the watershed which have been described above.

While the filtering of the water through 4 feet of gravel and 2 feet of charcoal, as previously described, will clarify the water to a great extent at times of high turbidity in the stream, little, if any, reliance can be placed upon this filtration for the removal of the bacteria or improving the sanitary quality of the water.

In conclusion it may, therefore, be stated:

1. That there now exists on the watershed numerous sources of serious contamination of the Bovina Center water supply.
2. That the efficiency of the gravel and charcoal filter, from a sanitary standpoint is practically nil.
3. That the enactment of rules and regulations for the protection from contamination of the water supply, a copy of the preliminary draft of which has already been transmitted to the water company, will undoubtedly greatly improve the quality of the supply by removing to a great extent the sources of contamination, providing the rules are properly enforced.
4. That, even with the enactment of rules and regulations, the population on the watershed is such and the location of the farm buildings relative to the stream such as to render the supply unsafe, for potable purposes without purification.

In view of the above I beg to offer the following recommendations to be acted upon by the Bovina Center Water Company:

1. That, as soon as the rules and regulations for the protection of the water supply from contamination are enacted, steps be immediately taken to enforce them.
2. That, a suitable filtration plant or apparatus for sterilizing the water with liquid chlorine or other equivalent treatment be provided for purifying the water before it is delivered to the consumer.
3. That, in order to determine more definitely the character of the water at all times and under all conditions, regular analyses of the water be occasionally made during the year.

Respectfully submitted,

THEODORE HORTON,
Chief Engineer

ALBANY, N. Y., *October* 19, 1915

BRIARCLIFF MANOR

HERMANN M. BIGGS, M.D., *State Commissioner of Health:*

An investigation of the public water supply of the village of Briarcliff Manor was made on July 15, 1915, by Mr. Morton F. Sanborn, assistant engineer. During the inspection the engineer was assisted by Dr. L. W. Hubbard, sanitary supervisor; Dr. E. H. Nall, health officer; Mr. Walter Law, jr., president of the village; Mr. Henry H. Law, member of the water board of the village, and Mr. Patrick Monahan, superintendent of the water department.

Briarcliff Manor is an incorporated village located in the valley of Pocantico creek, about 3 miles southeast of the village of Ossining. The population by the recent census is 1,300, while the 1910 census gave a population of 950. The water supply is owned by the municipality and serves practically all of the population as well as about 100 people in adjacent districts, and about 400 at Briarcliff Lodge from May to November. The average daily consumption for 1914 was 171,613 gallons. The average maximum daily consumption by months was 267,137 gallons during the month of September and the minimum was 93,970 gallons during the month of January. There are about 25 miles of mains ranging in size from 4 to 10 inches.

The water is obtained from 7 dug wells located in the southeastern part of the village near a small brook which is tributary to Pocantico creek. From these wells the water is pumped to the distributing system and to a reservoir

located on the hill in the northwestern part of the village and adjacent to Briarcliff Lodge. The average pressure is about 60 pounds and is obtained by means of reducers, while the maximum pressure at the pumping station is about 185 pounds.

The original water system was designed by Lederle & Provost, sanitary engineers of New York city, and the plant was constructed by the village under the direction of Lederle & Provost and Superintendent P. Monahan during 1904. Since that time additional wells have been dug as the necessity for additional water has arisen. The original plant consisted of two wells and a pumping station in which was placed a pump driven by a gasoline engine. In 1910 a new pumping station was erected and is in use at the present time.

There are now seven wells, which are located from 35 to 100 feet east of the creek above mentioned. These wells are all dug wells and are lined with a circular concrete tube which was sunk as the excavation proceeded. This tube extends about 3 feet above the ground in all cases. The wells are from 160 to 400 feet apart and are 16 feet inside diameter. Well No. 6, which is the northerly well, was excavated through 24 feet of coarse sand to rock. Well No. 2, which is the next well south, was excavated through 33 feet of fine sand. Well No. 1 was excavated through 28 feet of coarse sand. Well No. 3 was excavated through 10 feet of hardpan and 20 feet of coarse sand. Well No. 4 was excavated through coarse sand and boulders for a depth of 31 feet. Well No. 5 was excavated throught 5 feet of black muck and 26 feet of coarse sand. Well No. 7, which is the most southerly well, was excavated through 15 feet of black muck and 20 feet of coarse sand. These wells are all covered with a timber roof and ventilation is provided by the 2-foot space between the top of the concrete and the beginning of the roof. The open space is however covered with fine screens to keep out flies or other insects. At the time of the inspection the surface of the water in all the wells appeared to be at about the same elevation, which was approximately 3 feet below the surface of the water in the nearby brook.

A 5 or 6-inch suction passes through the side of each well and extends down to within 2 feet of the bottom of the wells. An 8-inch suction main connects with the suction of each well and leads to the pumping station. The station is located between the third and fourth wells and pumps the water from all or any of the wells as desired.

The pumping station is a wooden building about 40 feet square. In this station are located the pumps which deliver the water to the mains and reservoir. The pumping equipment consists of the following pumps and motors: One Dean 5-inch diameter, 8-inch stroke triplex pump rated at 115 gallons per minute and driven by a 24 h. p. Westinghouse motor; two Gould 6½-inch diameter, 8-inch stroke triplex pumps rated at 150 gallons per minute and driven by 30 h. p. Westinghouse motors; one Dean 6-inch diameter, 8-inch stroke triplex pump rated at 475 gallons per minute and driven by a 100 h. p. General Electric motor.

The suction lift was about 7 feet at the time of the inspection, although it must necessarily vary according to the height of water in the well. The static head pumped against is equivalent to 185 pounds per square inch and the additional pressure caused by the operation of the pumps is approximately 5 pounds for one of the small pumps, 15 pounds for two of the small pumps, and 45 pounds with the big pump in operation.

The reservoir is an iron reservoir 20 feet in diameter and 45 feet high with the top of some 145 feet above the ground. This reservoir has a capacity of 100,000 gallons and would therefore hold from 10 to 24 hours' consumption according to the time of the year.

A superintendent is in general charge of the water works and there is also an assistant superintendent and three operators, there being one operator at the pumping station at all times. At least one pump is kept continually in operation and others are operated as required. The reservoir was cleaned about two years ago and it is expected that it will be cleaned again next fall. The water mains are flushed out about once a year.

The watershed of the creek passing the wells has an area of about 2.6 square miles. At the time of the inspection it was estimated that about 0.5

cubic feet of water per second was flowing in the creek. As the water in the creek passed the lower well however it was estimated that 70 per cent of this flow had disappeared and undoubtedly had flowed through the ground and reached one or more of the wells. This creek has a general slope of about 60 feet per mile. The soil is generally of hardpan, sand and gravel, overlying rock of a schist and limestone formation. A small portion of the lower part of the watershed near the wells is somewhat swampy.

It is estimated that there is a population of about 100 living on the watershed and this would be equivalent to about 38 persons per square mile. There is probably some pollution of this stream from several houses and barns within 200 or 300 feet of the brook. On the Pleasantville road about 250 feet west of the creek was found a privy in a very unsatisfactory condition with excreta piled up above the ground. About 3,000 feet up the creek from the wells on a small tributary there are 3 or 4 acres which are being used as a pasture for swine. This tributary flows through the pasture and at the lower part of the pasture the brook was in a very foul condition. About 1½ miles above the wells there is located a barn adjacent to the creek and some pollution undoubtedly reaches the waters of the creek from the barnyard. Many of the houses have cesspools which were apparently in a satisfactory condition and any drainage reaching the brook from them must necessarily percolate through considerable soil before the water reaches the brook. Back of the pumping station and well removed from the wells is a brick building containing an incinerator with 4 seats and 2 urinal tanks for the use of the pumpmen. This building had a cement floor and was apparently in a sanitary condition.

About four years ago the village authorities had several nuisances around the brook removed, although since that time there has been no protection of any sort of the brook water. This creek has not previously been considered as affecting the quality of the water supply and no rules have been made for the protection of the water from contamination. There has been practically little or no typhoid fever either on the watershed or in the village.

Analyses of samples of water from the different wells and from the brook flowing past the wells taken on August 19, 1915, as well as analyses made previously by the Division of Laboratories and Research, will be found in the appended table.

These analyses show a water which, although usually clear and colorless, is at times both colored and turbid. This occasional occurrence of turbidity and color is additional evidence of a mixture of surface water with the ground water. The water in general is quite hard. The results for nitrogen in the different forms indicate considerable organic pollution, past and present, and this conclusion is borne out by the high value of chlorine. The bacterial count also is high at times and bacteria of the B. coli group are frequently found in 10 c. c. and occasionally in 1 c. c. samples. In the case of well No. 7 the amount of iron present is excessively high, so high indeed that the water is not suitable for domestic purposes. This high iron content is probably due to the character of the soil through which the well was sunk.

The analyses of the brook water show considerable color and odor and the figures for nitrogen and oxygen consumed show considerable organic pollution. This pollution is also shown by the high bacterial count and the presence of B. coli in 1/10 c. c. samples. The brook water is somewhat softer than that of the spring water.

As a result of this investigation and of the analyses the following conclusions may be drawn:

1. That the water supply of Briarcliff Manor is evidently contaminated at times, due to infiltration into the wells of the polluted brook water. At the time of the inspection it was very evident that a considerable amount of the brook water was flowing to the wells.

2. That the brook water is seriously polluted by drainage from farm lands, animal enclosures and privies.

3. That the filtration of the water from the brook during its passage through the soil into the wells is evidently not sufficient to bring about proper purification of the water at all times.

4. That the high iron content in the water in well No. 7 renders the water from this well unsatisfactory for domestic purposes without special treatment for the removal of iron.

In view of the above conclusions, I would recommend that the village authorities take the following steps to safeguard the sanitary quality of their water supply:

1. Remove all sources of pollution now existing on the watershed of the brook flowing near the wells and in case any difficulty is experienced in carrying out this recommendation apply to this Department for the enactment of water rules for the sanitary protection of the waters of this brook.
2. Install and operate, under competent supervision, apparatus for the sterilization of the water supply.
3. Use the water from well No. 7 only in case of fire, unless a special treatment plant for the removal of iron is installed.

Respectfully submitted,

THEODORE HORTON,

Chief Engineer

ALBANY, N. Y., *September* 30, 1915

RESULTS OF WATER ANALYSES

Abbreviations used to describe odors of water: 0, none; 1, very faint; 2, faint; 3, distinct; 4, decided; 5, strong; 6, very strong; a, aromatic; d, disagreeable; e, earthy; f, fishy; g, grassy; m, musty; v, vegetable

Municipality	County	Source of sample	Date of collection	Physical				Chemical (Parts Per Million)											Bacteriological			
						Odor		Solids			Nitrogen as—						Hardness			B. Coli Type + = present — = absent		
				Color	Turbidity	Cold	Hot	Total	Loss on ignition	Mineral residue	Free ammonia	Albuminoid ammonia	Nitrites	Nitrates	Oxygen consumed	Chlorine	Total	Alkalinity	Bacteria per c.c.; gelatin 20°, 48 hours	10 c.c.	1 c.c.	1-10 c.c.
Briarcliff Manor	Westchester...	Tap in pump room........	1/14/11	Tr.	Cl.	....	....	303	....	235	.004	.128	.010	1.00	1.25	6.75	140.0	74.0	2,000	+	+	—
Briarcliff Manor	Westchester...	Mixed wells, public supply...	3/15/11	Tr.	Cl.	....	....	275	....	226	.014	.048	.003	1.20	1.00	6.75	74.3	66.0	500	+	—	—
Braircliff Manor	Westchester...	Tap, public supply........	12/14/11	Tr.	Cl.	....	....	304	....	265	.006	.032	.001	0.80	0.60	6.00	102.8	97.0	50	—	—	—
Briarcliff Manor	Westchester...	Tap, public supply........	2/22/12	15	5	....	....	127	....	117	.012	.048	.001	0.60	2.90	4.50	50.0	36.0	1,200	+	—	—
Briarcliff Manor	Westchester...	Tap, public supply........	3/27/12	Tr.	Cl.	....	....	271	....	228	.004	.012	Tr.	1.20	0.10	6.50	122.8	85.0	1,800	—	—	—
Briarcliff Manor	Westchester...	Tap, public supply........	4/ 9/12	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	60	+	—	—
Briarcliff Manor	Westchester...	Tap, public supply........	8/28/12	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	10	—	—	—
Briarcliff Manor	Westchester...	Tap, public supply........	12/19/12	Tr.	Cl.	....	....	274	....	248	.024	.030	Tr.	0.40	0.80	6.75	120.0	82.0	30	+	—	—
Briarcliff Manor	Westchester...	Tap, public supply........	1/22/13	Tr.	Cl.	....	....	317	....	....	.010	.034	Tr.	0.70	0.50	5.50	160.0	102.0	10	—	—	—
Briarcliff Manor	Westchester...	Tap, public supply........	4/ 9/13	Tr.	Cl.	....	....	259	....	....	.018	.022	Tr.	1.00	0.80	5.75	195.0	82.0	70	—	—	—
Briarcliff Manor	Westchester...	Tap, public supply........	7/ 3/13	5	Cl.	....	....	232	....	....	.002	.014	.003	0.70	0.50	5.75	134.2	75.0	200	—	—	—
Briarcliff Manor	Westchester....	Tap in pumping station.....	1/29/14	Tr.	Cl.	1 v.	1 v.	257	40	217	.004	.006	Tr.	0.40	1.00	5.50	160.0	81.0	550	—	+	—
Briarcliff Manor	Westchester....	Tap in pumping station.....	3/ 3/14	2	Tr.	1 v.	1 v.	238	28	210	.016	.022	.001	0.50	0.90	5.75	137.2	75.0	20	—	—	—
Briarcliff Manor	Westchester....	Well No. 7..............	9/24/14	8	5	1 v.	1 v.	339	37	302	.112	.020	.002	0.16	2.10	5.75	162.8	51.0	445	+	—	—
Briarcliff Manor	Westchester....	General supply...........	9/24/14	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	950	—	—	—
Briarcliff Manor	Westchester....	Tap at pumping station*....	8/19/15	1	2	1 v.	1 v.	229	42	187	.018	.022	.002	0.50	.080	4.75	120	67.0	20	2+1—	0+3—	0+3—
Briarcliff Manor	Westchester....	Well No. 7†..............	8/19/15	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	70	3+0—	2+1—	1+2—
Briarcliff Manor	Westchester....	Well No. 6..............	8/19/15	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	250	3+0—	1+2—	0+3—
Briarcliff Manor	Westchester....	Well No. 5..............	8/19/15	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	650	3+0—	2+1—	0+3—
Briarcliff Manor	Westchester....	Well No. 4‡..............	8/19/15	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	120	3+0—	0+3—	0+3—
Briarcliff Manor	Westchester....	Well No. 3‡..............	8/19/15	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	100	3+0—	1+2—	0+3—
Briarcliff Manor	Westchester....	Well No. 2§..............	8/19/15	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	4,500	3+0—	3+0—	2+1—
Briarcliff Manor	Westchester....	Well No. 1‡..............	8/19/15	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	850	3+0—	3+0—	1+2—
Briarcliff Manor	Westchester....	Brook at Well¶............	8/19/15	10	Tr.	3 v.	v.3	92	10	82	.006	.076	.002	.120	4.30	3.25	37.7	22.0	3,700	3+0—	3+0—	2+1—

* Iron 0.5. † Iron 5.00. ‡ Iron trace. § Iron 0.4. ¶ Iron 0.3.

BRIDGEHAMPTON

HERMANN M. BIGGS, M.D., *State Commissioner of Health:*

An investigation of the public water supply of Bridgehampton, L. I., was made by Mr. C. M. Baker, assistant engineer, on May 10, 1915.

Bridgehampton is located in the county of Suffolk on the Montauk Branch of the L. I. R. R. about ninety-seven miles from New York City. It is not incorporated as a village but is laid out in a water district in accordance with the Town Law relative thereto. The population in the water district is estimated at about 500.

The district is served with water by a private company controlled by J. A. Sandford & Sons. The supply is derived from three driven wells and the water is pumped into tanks under air pressure whence it is forced through the mains to the consumers. About 90 per cent. or 450 of the population are served with water. There is a total of 168 service taps of which only 48 are metered. The water consumption is about 30,000 gallons per day during the winter months and about 100,000 gallons daily during the summer, the average daily consumption throughout the year being about 50,000 gallons which corresponds to a per capita rate of 110 gallons daily. The variation in consumption is due principally to the extra water used in the summer for sprinkling purposes, there being but little variation in the population. The pressure from the water tanks varies from 35 to 70 pounds, it being the practice of the company not to allow the pressure to drop below the former figure. There are no municipal fire hydrants connected with the system.

The plant is located near the center of the village in the basement of a hardware store owned by the company controlling the water supply. The wells consist of one 4-inch well 312 feet deep and a 6-inch and 4-inch well each 260 feet deep. The strata through which the wells pass from the surface down is as follows: loam and clay 0–5 feet, sand 5–70, clay 70–100, sand and gravel 100–135, gray clay 135–140, sand 140–170, gray clay with fragments of shells 170–190, sand 190–220, sand and lignite 220–230, lignite 230–237, sand 237–275, lignite 275–280, clay 280–290, white porous stone formation 290–312. Two gasoline engines of 18 horse power each operate two pumps with capacities of 180 gallons per minute each. The suction lift of the pumps is about 15 feet. The storage tanks consist of two metal tanks of about 9,000 gallons capacity each, one being used for the storage of water and the other for air. There are 800 feet of 6-inch mains, 8,454 of 4-inch, 11,962 of 3-inch and about 1,000 of 2-inch or a total of 22,216 feet.

As mentioned above the wells are located in the center of the village. The density of population within a radius of one-quarter mile is equivalent to about 1,000 persons per square mile and within one-half mile to about 748 per square mile. The sewage is disposed of by means of leaching cesspools or privies. A leaching cesspool is located about 120 feet from the wells, one privy about 150 feet distant and another about 200 feet distant. These privies are not provided with removable vaults and, in fact, the surroundings in the neighborhood were very insanitary. The total area of the surface watershed tributary to the wells is about 2.71 square miles and the average population per square mile on this watershed is about 203 people.

A sample of the water was collected and sent to the Division of Laboratories and Research for analysis, the results of which are as follows:

REPORT OF WATER ANALYSIS FOR BRIDGEHAMPTON

Laboratory No.	
Source	Tap at pumping station
Collected on	May 10, 1915
Color	Trace
Turbidity	Clear
Odor, cold	1 vegetable
Odor, hot	1 vegetable
Solids, total	72
Loss on ignition	15
Mineral residue	67
Ammonia, free	Trace
Ammonia, albuminoid	.004
Nitrites	.001
Nitrates	3.60
Oxygen consumed	0.50
Chlorine	16.75
Hardness, total	28.60
Alkalinity	4.00
Iron	0.05
Bacteria per c.c.	10
B. coli type	10 c.c.— 1 c.c.— 1-10 c.c.—

Results are expressed in parts per million + Present, — Absent. Abbreviations used to describe odors of water: 0, none; 1, very faint; 2, faint; 3, distinct; 4, decided; 5, strong; 6, very strong; a, aromatic; d, disagreeable; e, earthy; f, fishy; g, grassy; m, musty; v, vegetable.

The results of the analyses indicate only a small amount of nitrogenous matter present in the form of free and albuminoid ammonia and nitrites. The figure of 3.60 parts per million for nitrates is considerably above the normal and although the normal chlorine content of the water in this locality is not definitely known, it would seem that it is somewhat less than the figure of 16.75, the amount found present in the sample analyzed. The bacterial content is low and organisms of the B. Coli type were absent. The water is quite soft and its physical qualities are satisfactory.

The presence of organic matter in the lignite strata and possibly in the strata containing shells probably accounts to some extent for the high nitrates. However it is possible that the presence of the nitrates and chlorine is partly due to pollution from the various cesspools and privies located in close proximity to the wells but the ratio of the amounts due to pollution and to natural conditions is indeterminate. The clay strata through which the wells pass are probably only ledges or pockets of clay, as such formations are quite characteristic of Long Island and it is, therefore, probable that the water is drawn from the general ground water and is not entirely protected from polluted subsurface water by impervious layers. It is also possible that other wells in the village improperly protected from contamination, may act as channels by means of which pollution may enter the ground water below these clay strata. In any event, it seems very objectionable and undesirable to have wells located in a center of population as these are. As stated above the analyses indicate the possibility of pollution having found its way into the wells although it is apparent from the low bacterial content and the absence of B. coli and also from the low figures for free and albuminoid ammonia and nitrites that such pollution has become well purified in its passage through the soil and thus rendered inactive. Nevertheless, the dense population in the neighborhood of the wells, with its present method of sewage disposal, namely cesspools and privies, is a menace to the water supply since it is quite possible that this contamination may, under certain hydraulic conditions of the ground water and at times when the draft on the wells is at a maximum, become active, thus causing dangerous contamination.

As a result of this investigation and from a study of the analyses made of the water taken at the time of the inspection it is apparent that, although the wells are unfortunately located in the center of a comparatively densely populated area improperly sewered, the analyses indicate that the

pollution has been well purified in its passage through the soil before reaching the source of the supply; nevertheless, it would seem that under certain hydraulic conditions of the ground water it is possible that active contamination may at times find its way into the water supply. I, therefore, beg to submit the following recommendations to be acted upon by tthe water company:

1. That all sources of ground water pollution within a radius of 500 feet of the wells be removed.

(a) By providing watertight removable containers for all privies and reconstructing all cesspools so that they are impervious and further, by removing the contents from these places and disposing of them in a satisfactory manner at sufficiently frequent intervals to maintain sanitary conditions at all times, or

(b) By providing a sewer system of satisfactory design and construction, the plans for which should be approved by this Department as required by law, to collect and dispose of the sewage in the vicinity of the wells.

2. That analyses of the water be regularly made at frequent intervals to detect any active contamination which may occur.

3. That should active contamination be found to occur at any time, a new supply of a satisfactory sanitary quality be developed, or if found practicable, the present supply be sterilized by chlorination or some other equally effective and practical method.

Respectfully submitted,

THEODORE HORTON,
Chief Engineer

ALBANY, N. Y., *June* 9, 1915

BROCKPORT

HERMANN M. BIGGS, M.D., *State Commissioner of Health:*

An investigation of the public water supply of the village of Brockport was made on September 9, 1915, by Mr. E. S. Chase, assistant engineer in this Department, accompanied by Dr. J. L. Hazen, health officer, and Mr. George B. Trout, superintendent of the water works.

Brockport is an incorporated village located near the western boundary of Monroe county upon the line of the Erie canal and the Niagara Falls branch of the New York Central and Hudson River railroad. The population is estimated at about 3,750. The village is served by a sewer system and sewage disposal plant. Plans for a new disposal plant have been recently approved by this Department.

The village was formerly served by a water supply system owned by the Brockport-Holley Water Company, but owing to the fact that this company was unable to supply a sufficient quantity of water for the needs of the village, the village installed a new system, municipally owned, which has been in operation since February, 1914. This new system was designed by Whitmer & Brown, civil engineers of Buffalo, and built by contract under their direction. The water supply is derived from Lake Ontario at a point about 12 miles north of Brockport. The water is pumped through pressure mechanical filters and thence into the main leading to the village. There are 17 miles oı cast-iron water mains ranging in size from 4 to 14 inches in diameter. Of the 1,130 service taps, 775 are metered. The daily water consumption is from 350,000 to 400,000 gallons. The average pressure in the village is 80 pounds per square inch. In addition to supplying the village of Brockport itself, a few consumers in the village of Clarkson receive the water. The Hamlin water district is also supplied from this source by a 6-inch connection with the force main leading from the pumping station to Brockport. The water works are under the direction of the board of water commissioners, of which Mr. A. M. White is chairman.

The intake pipe consists of two 12-inch pipes 300 feet in length, which are laid in a trench in the bottom of the lake refilled with broken stone. From

this intake the water is delivered by gravity to a combined impounding well and coagulating basin of concrete. This basin was divided into two parts by a wall built along the diameter. As operating at present this basin acts simply as a suction well. From this well the water is pumped by two horizontal duplex plunger pumps through pressure mechanical filters made by the New York Continental Jewell Filtration Company. These filters are 8 feet in diameter and 24 feet long. Alum is used as a coagulant and is applied by means of the shunt system. The plant is operated eight hours each day, reserve storage being provided by a reservoir located in the southern part of the village. At the time of the inspection the filters were being operated at the rate of 100 million gallons per acre per day. The water is also treated by hypochlorite of lime applied by means of a hypochlorite plant consisting of solution tanks, constant level tanks and calibrated orifices. The solution is applied to the raw water at the suction well of the pump.

At the time of the inspection difficulty had been experienced in obtaining the potash alum which was used in the alum pots owing to a shortage caused by the war in Europe. Subsequent to the inspection letters of advice were sent to the board of water commissioners advising the discontinuance of the alum pots and the substitution of gravity feed, using sulphate of aluminum. The analyses of the raw and filtered water show clearly that very little if any alum was being applied at the time of the inspection, as the alkalinity was reduced only one part per million, whereas in the cases where alum is applied in appreciable quantities the alkalinity is reduced 6 to 8 parts per million for each grain of alum per gallon.

The sanitary quality of the Lake Ontario water is too well known to require extended discussion in this report. The largest amount of contamination received into the lake in the vicinity of the Brockport intake is that from the sewers of the city of Rochester, which are discharged into the Genesee river, which in turn empties into the lake about 20 miles east of the intake. Under conditions of easterly storms and high winds from that direction it is barely possible that the small amount of pollution from this source reaches the vicinity of the intake. The water from the lake near the shore is frequently very turbid, due to wave action.

At the time of the inspection samples of water were collected and the results of the analyses of these samples, together with others made in the past by the Division of Laboratories and Research, will be found in the appended table.

These analyses show a moderately contaminated raw water. The total bacterial count in the filtered water at the time of the inspection was verv high, but this may be due to the fact that the samples were two days in reaching the laboratories and that the ice in the containers had melted during transit. However, fecal organisms of the B. coli type were removed by the filters.

In view of the above facts, the following conclusions may be drawn:

1. That the source of raw water from Lake Ontario for the Brockport public water supply is possibly open to a small amount of intermittent contamination from the sewage of the city of Rochester discharged into the lake through the Genesee river. The water of the lake is also at times very turbid.

2. That the installation of a filtration plant for the treatment of this water was fully warranted by the character of the raw water.

3. That the filter plant, although not of the type capable of the highest bacterial efficiency in itself, used in conjunction with proper coagulation and subsidence supplemented by sterilization, will afford a safe and wholesome water supply for the village if properly operated at all times.

I would therefore recommend:

1. That, as recently advised by this Department, the shunt system of alum application be abandoned and measures taken for constantly applying the coagulant by means of a gravity feed apparatus.

2. That is would be advisable to consider the use of the present hypochlorite plant, if possible, for the application of the alum solution and the substitution of apparatus for applying liquid chlorine to the water instead of hypochlorite of lime.

In view of the prime importance of efficient operation of the filter plant as pointed out above, it is suggested that the village follow out the plan which is now being quite generally adopted by the more progressive water works managements in this State, of engaging the services of a competent consulting expert to make occasional visits to the plant during the year to study the local conditions and operation of the filters and to give detailed advice as to the best methods to employ to improve the operation of the plant and maintain it at its highest possible efficiency.

Respectfully submitted,

THEODORE HORTON,
Chief Engineer

ALBANY, N. Y., *October* 5, 1915

REPORT OF WATER ANALYSIS FOR BROCKPORT

Source		Tap in Village	Suction well Raw Water	Tap Filtered Water
Collected on		Apr. 22/14	Sept. 9/15	Sept. 9/15
Color		10	tr.	tr.
Odor, hot		1 v.	3 v.	1 a
Odor, cold		1 v.	3 v.	1 a
Turbidity		15	tr.	d.
Solids, total		166	232	220
Loss on ignition		28	50	50
Mineral residue		138	182	170
Ammonia, free		.018	.046	.002
Ammonia, albuminoid		.096	.066	.032
Nitrites		.001	.003	tr.
Nitrates		0.24	.010	0.18
Oxygen consumed		4.10	4.40	4.00
Chlorine		7.75	8.25	8.00
Hardness, total		111.4	100.0	100.0
Alkalinity		92.0	93.0	92.0
Bacteria per c.c.		190	1,100	74,000
B. coli type	10 c.c.	....	1+2—	0+3—
	1 c.c.	....	0+3—	0+3—
	1/10 c.c.	....	0+3—	0+3—

Results are expressed in parts per million. + Present. — Absent.
Abbreviations used to describe odors of water: 0, none; 1, very faint; 2, faint; 3, distinct; 4, decided; 5, strong; 6, very strong; a, aromatic; d, disagreeable; e, earthy; f, fishy; g, grassy; m, musty; v, vegetable.

CAMDEN

HERMANN M. BIGGS, M.D., *State Commissioner of Health:*

A reinspection of the water supply of Camden was made on October 13, 1915, by Dr. J. E. Clark, sanitary supervisor of district "E." A previous inspection of this supply was made in 1908 by the Engineering Division, a full report of which will be found on page 285 of Vol. 2 of the Thirtieth Annual Report of this Department.

The water supply of Camden is derived from an impounding reservoir on Emmons brook at a point about two miles northeast of the village. From this reservoir the water is distributed by gravity to the village. The water works system remains practically the same as described in detail in the earlier report. The water works are owned and operated by the municipality.

The watershed of Emmons brook, directly tributary to the reservoir, is approximately 1.5 square miles in area. The topography is moderately steep except for swampy areas adjacent to the stream. A large portion of the area is used for agriculture and the remainder is wooded. There are five dwellings upon the watershed and the total population may be estimated at about 15, or 10 per square mile. The majority of these houses are distant from the stream and probably cause no direct contamination. At one farmhouse, owned by

Abraham Lafferty, about one mile above the reservoir, the drainage from the house, pigpen, barn, manure pile and privy finds its way into a small watercourse tributary to the main stream. In addition to the contamination from this farm there is also opportunity for contamination by road wash where the highway crosses the brook and by drainage from pasture land and cultivated fields. At some points cattle have access to the stream.

The previous report recommended that a careful oversight be maintained at all times of the sanitary conditions upon the watershed, that regular inspections be made from time to time, and that in the case of the occurrence of typhoid fever upon the watershed precautionary measures be taken at once to close up all channels of infection and spread of the disease. It was also recommended that the water board consider the question of application to this Department for the enactment of rules and regulations for the protection of their supply in case of difficulty in removing any sources of pollution.

From the report of Dr. Clark it appears that inspections are made by the water board at more or less regular intervals and that at the time of the occurrence of the case of typhoid on the watershed about six years ago special precautions were taken to prevent any infection of the water supply. No application however has been made to this Department for the enactment of rules and regulations.

At the time of his inspection Dr. Clark collected samples of water and the results of the analyses of these samples, together with others made in the past by the Division of Laboratories and Research, will be found in the appended table.

These analyses show a water slightly colored, usually clear, although at times turbid, and comparatively soft. The figures for nitrogen in its various forms, although somewhat high, are consistent with the conditions upon the watershed and indicate the occurrence of moderate amounts of decomposing and decomposable organic matter of animal or vegetable origin. The chlorine content is also somewhat higher and more variable than normally found in unpolluted waters in this region. The total bacterial counts are rather high and fecal organisms of the B. coli type are found usually in 10 c. c. samples, frequently in 1 c. c. and occasionally in 1/10 c. c. These bacterial results indicate the occurrence of active contamination of animal or human origin. From the conditions upon the watershed it seems probable that the greater amount of this contamination is due to cattle pastured near the stream, although there is also a strong probability that intermittent contamination is caused by the residents upon the watershed, and possibly by chance visitors thereto.

In view of the above facts, the following conclusions may be drawn:

1. That the village authorities of Camden have carried out the previous recommendations of this Department in respect to inspections of the watershed, although no application has been made for the enactment of rules and regulations.

2. That the water supply of Camden is of a reasonably satisfactory physical quality, although slightly colored and occasionally turbid.

3. That the water supply is subject to indirect contamination of animal origin by surface wash from pasture land, highways and the vicinity of dwellings, and it is also subject to direct contamination by cattle wading in the stream or tributary watercourses.

4. That the water supply is open to contamination of human origin from the privy at the Lafferty place and to accidental, incidental or wilful contamination by residents upon the watershed or transient visitors thereto.

I would therefore recommend:

1. That the village authorities continue their careful oversight of the sanitary conditions upon the watershed.

2. That such authorities take active steps to remove and abate the specific insanitary conditions noted above and any others which may be found to occur, and in case of any difficulty in securing the abatement of these conditions they apply to this Department for the enactment of rules and regulations for the sanitary protection of the watershed.

3. That, in view of the ever present possibility of accidental or chance contamination and possible infection of the supply, the village consider the advisability of installing and efficiently operating suitable apparatus for the sterilization of the supply with liquid chlorine.

Respectfully submitted,

THEODORE HORTON,
Chief Engineer

ALBANY, N. Y., *December* 21, 1915

REPORT OF WATER ANALYSIS FOR CAMDEN

Source	Tap public supply	Tap public supply	Tap public supply	Tap public supply	Tap public supply	Tap public supply
Collected on	6/5/11	8/16/11	9/29/11	11/18/11	2/19/12	5/1/12
Color	40	10	tr.	30	3	15
Odor, hot	....	....	....	....	....	....
Odor, cold	....	....	....	....	....	....
Turbidity	3	3	cl.	13	cl.	5
Solids, total	85	83	90	74	70	69
Loss on ignition	....	....	....	....	....	....
Mineral residue	51	68	70	57	60	55
Ammonia, free	.006	.012	.006	.004	.020	.004
Ammonia, albuminoid	.120	.054	.024	.072	.042	.088
Nitrites	.002	.001	.001	.001	tr.	tr.
Nitrates	0.40	0.30	0.24	0.40	0.52	0.36
Oxygen consumed	6.10	0.55	0.30	4.00	1.64	3.70
Chlorine	0.75	0.62	0.75	0.62	0.62	3.00
Hardness, total	48.6	65.7	70.0	40.3	60.0	51.4
Alkalinity	48.0	63.0	62.0	35.0	51.0	45.0
Bacteria per c.c	13,500	7,000	275	950	50	650
B. coli type... 10 c.c.	+	+	+	+	+	+
B. coli type... 1 c.c.	+	—	+	+	—	—
B. coli type... 1/10 c.c.	+	—	—	—	—	—

Results are expressed in parts per million. + Present. — Absent.

Abbreviations used to describe odors of water: 0, none; 1, very faint; 2, faint; 3, distinct; 4, decided; 5, strong; 6, very strong; a, aromatic; d, disagreeable; e, earthy; f, fishy; g, grassy; m, musty; v, vegetable.

REPORT OF WATER ANALYSIS FOR CAMDEN

Source	Tap, public supply	Tap, public supply	Tap, public supply	Tap, public supply	Tap, public supply	Tap, public supply
Collected on	8/1/12	10/31/12	11/30/12	1/13/13	2/19/13	4/1/13
Color	7	15	10	5	tr.	10
Odor, hot	....	....	....	....	....	....
Odor, cold	....	....	....	....	....	....
Turbidity	cl.	cl.	tr.	tr.	cl.	tr.
Solids, total	100	109	76	57	68	60
Loss on ignition	....	....	....	....	....	....
Mineral residue	80	87	58	....	....	....
Ammonia, free	.002	.022	.012	.008	.010	.024
Ammonia, albuminoid	.018	.096	.092	.050	.064	.048
Nitrites	tr.	tr.	tr.	tr.	tr.	tr.
Nitrates	0.48	0.40	0.40	0.36	0.36	0.18
Oxygen consumed	0.90	2.20	2.60	2.80	1.80	2.50
Chlorine	0.50	0.25	0.50	0.75	0.75	0.75
Hardness, total	60.00	60.00	50.00	41.60	50.00	33.80
Alkalinity	58.00	53.00	46.00	34.00	47.00	33.00
Bacteria per c.c	620	400	450	750	100	350
B. coli type... 10 c.c.	—	+	+	+	—	+
B. coli type... 1 c.c.	—	+	+	—	—	—
B. coli type... 1/10 c.c.	—	+	—	—	—	—

Results are expressed in parts per million. + Present. — Absent.

Abbreviations used to describe odors of water: 0, none; 1, very faint; 2, faint; 3, distinct; 4, decided; 5, strong; 6, very strong; a, aromatic; d, disagreeable; e, earthy; f, fishy; g, grassy; m, musty; v, vegetable.

REPORT OF WATER ANALYSIS FOR CAMDEN

Source	Tap, public supply	Tap, public supply	Tap, public supply	Tap, public supply	Tap, public supply	Reserve public supply
Collected on	5/14/13	6/24/13	7/30/13	5/18/14	10/13/15	10/13/15
Color	tr.	tr.	8	10	....	10
Odor, hot	....	....	....	1 v	....	....
Odor, cold	....	....	....	1 v	....	....
Turbidity	cl.	cl.	2	tr.	....	cl.
Solids, total	78	94	98	73	....	76
Loss on ignition	....	....	....	12	....	11
Mineral residue	....	....	....	61	....	65
Ammonia, free	.004	.004	.012	.002	....	.012
Ammonia, albuminoid	.042	.026	.054	.026	....	.038
Nitrites	tr.	.001	.001	.001	....	.001
Nitrates	0.26	0.46	0.32	0.30	....	0.16
Oxygen consumed	0.90	0.90	2.60	2.40	....	6.20
Chlorine	0.75	2.00	0.50	0.25	....	3.50
Hardness, total	60.0	61.4	61.4	57.1	....	54.3
Alkalinity	54.0	59.0	60.0	50.0	....	54.0
Bacteria per c.c.	200	160	220	300	120	350
B. coli type 10 c.c.	+	+	+	+	2+1—	2+1—
B. coli type 1 c.c.	—	+	+	+	0+3—	1+2—
B. coli type 1/10 c.c.	—	—	+	—	0+3—	1+2—

Results are expressed in parts per million: + Present. — Absent.
Abbreviations used to describe odors of water: 0, none; 1, very faint; 2, faint; 3, distinct; 4, decided; 5, strong; 6, very strong; a, aromatic; d, disagreeable; e, earthy; f, fishy; g, grassy; m, musty; v, vegetable.

CANANDAIGUA

HERMANN M. BIGGS, M.D., *State Commissioner of Health:*

A reinspection of the water supply of Canandaigua was made on August 10, 1915, by Dr. Isaac W. Brewer, sanitary supervisor of District "Q". A previous investigation of this supply was made in 1909 by the Engineering Division, the full report of which will be found on page 287 of the Thirtieth Annual Report of this Department.

The water supply of Canandaigua is pumped from Canandaigua Lake at a point two miles south of the city and is distributed by gravity from a reservoir about ½ mile west of the pumping station. The intake consists of a 16-inch pipe extending about 500 feet from shore in 50 feet of water. The pumping station and the water works system in general remain practically the same as described in detail in the earlier report. The water works are owned and operated by the municipality.

Canandaigua Lake has a surface area of about 16 square miles and the total watershed area tributary to it is approximately 172 square miles. There are several small villages located upon this watershed and a great many scattered farm houses. In addition, numerous summer cottages are scattered along the shores of the lake. The total population upon the watershed has been estimated at approximately 6,500, or 38 per square mile.

At the time of Dr. Brewer's inspection he found that the sanitary conditions along the shores of the lake were very good. At one or two points near the head of the lake there are privies which are liable to drain into the waters of the lake. The owners, however, have undertaken to relocate them so that there will be no danger of contamination of the lake water. There is a large summer population in the vicinity of the lake and its waters are largely used for bathing, boating and fishing. There are also steamers which ply upon the lake but these are provided with watertight compartments connected with the toilets on the boats. The contents from these compartments are not discharged into the lake but into its outlet.

In the earlier report the various opportunities for intermittent contamination of the lake were clearly pointed out and it was recommended that the

question of eliminating the pollution and protecting the water supply against further and accidental pollution be carefully considered, especially in regard to the possibility of applying to this Department for the enactment of rules and regulations for the sanitary protection of the lake. It was pointed out also that it seemed inevitable that some form of purification would be needed in the future.

From the report of Dr. Brewer it appears that the local authorities have been to some extent active in the prevention of contamination of the lake water although as yet, no application has been made to this Department for the enactment of rules and regulations.

At the time of his inspection, Dr. Brewer collected samples of this supply and the result of the analyses of these samples together with others made in the past by the Division of Laboratories and Research will be found in the appended table.

These analyses show a very hard water, usually colorless and clear, although at times slight amounts of color and turbidity are present. The bacterial results are as a rule satisfactory, being low in total numbers and with the B. coli type usually absent. Occasionally, however, B. coli are found in 10 c. c. samples indicating a certain amount of active contamination of animal or human origin.

In view of the above facts the following conclusions may be drawn:

1. That the Board of Water Commissioners of Canandaigua have apparently taken steps to eliminate the chief sources of direct contamination of their water supply.

2. That the supply derived from Canandaigua Lake while in the main, of a good sanitary and esthetic quality, is open to intermittent contamination due to the use of the lake and shores for pleasure purposes as well as to the general contamination from a populated watershed.

I would therefore recommend:

1. That the city authorities continue their efforts to reduce the number of permanent sources of contamination.

2. That, in case any difficulty be experienced in carrying out the above recommendations or if it be deemed advisable as a precautionary measure to prevent additional contamination in the future, the city authorities should apply to this Department for the enactment of rules and regulations for the sanitary protection of the waters of the lake.

3. That in view of the always present possibility of accidental or wilful contamination of the water of the lake in the immediate vicinity of the intake, and that active contamination has occurred is evidenced by the analyses, the city should install and operate suitable apparatus for the sterilization of their supply with liquid chlorine. In case such apparatus is installed it should at all times be carefully operated and, if possible, under the supervision of a competent expert.

Respectfully submitted,

THEODORE HORTON,

Chief Engineer

ALBANY, N. Y., *September* 22, 1915

RESULTS OF WATER ANALYSES

Abbreviations used to describe odors of water: 0, none; 1, very faint; 2, faint; 3, distinct; 4, decided; 5, strong; 6, very strong; a, aromatic; d, disagreeable; e, earthy; f, fishy; g, grassy; m, musty; v, vegetable

Municipality	County	Source of sample	Date of collection	Physical				Chemical (Parts Per Million)												Bacteriological			
						Odor		Solids			Nitrogen as—						Hardness				B. Coli Type + = present — = absent		
				Color	Turbidity	Cold	Hot	Total	Loss on ignition	Mineral residue	Free ammonia	Albuminoid ammonia	Nitrites	Nitrates	Oxygen consumed	Chlorine	Total	Alkalinity	Bacteria per c.c.; gelatin 20°; 48 hours	10 c.c.	1 c.c.	1-10 c.c.
Canandaigua	Ontario	Tap, public supply	1/13/12	Tr.	3	....	....	158	22	131	.012	.070	Tr.	0.34	1.30	2.37	120.0	109.0	200	—	—	—
Canandaigua	Ontario	Tap, public supply	2/21/12	5	Cl.	....	....	145	30	115	.008	.055	Tr.	0.40	1.60	2.25	105.8	103.0	375	++	—	—
Canandaigua	Ontario	Tap, public supply	4/ 2/12	5	35	....	....	179	19	160	.010	.074	Tr.	0.30	0.60	2.00	117.2	103.0	700	+	—	—
Canandaigua	Ontario	Tap, public supply	4/23/12	Tr.	Cl.	....	....	145	12	133	.002	.056	Tr.	0.36	0.80	2.50	122.8	105.0	700	—	—	—
Canandaigua	Ontario	Tap, public supply	10/ 8/12	10	Tr.	....	....	132	26	106	.004	.066	.001	0.20	2.00	1.75	102.8	101.0	600	—	—	—
Canandaigua	Ontario	Tap, public supply	11/28/12	5	Cl.	....	....	150	21	129	.008	.070	Tr.	0.26	1.80	2.25	120.0	105.0	50	—	—	—
Canandaigua	Ontario	Tap, public supply	12/31/12	Tr.	Tr.	....	....	145	....	....	.003	.074	Tr.	0.30	1.70	2.25	111.4	107.0	50	—	—	—
Canandaigua	Ontario	Tap, public supply	2/10/13	Tr.	Cl.	....	....	146	....	....	.004	.092	Tr.	0.24	1.90	4.25	128.6	108.0	400	—	—	—
Canandaigua	Ontario	Tap, public supply	3/22/13	3	Cl.	....	....	142	....	....	.008	.084	Tr.	0.36	1.60	2.25	114.2	106.0	80	—	—	—
Canandaigua	Ontario	Tap, public supply	5/17/13	15	8	....	....	147	....	....	.008	.082	.001	0.30	1.40	2.25	105.8	104.0	210	—	—	—
Canandaigua	Ontario	Tap, public supply	6/23/13	2	Cl.	....	....	135	....	....	.004	.052	.001	0.16	1.00	2.00	111.4	105.0	30	—	—	—
Canandaigua	Ontario	Tap, public supply	7/26/13	Tr.	5	....	....	160	....	....	.004	.080	Tr.	0.16	1.80	2.25	108.6	105.0	60	+	—	—
Canandaigua	Ontario	Tap, public supply	5/ 1/14	5	3	1 v.	1 v.	146	20	126	.006	.069	Tr.	0.44	1.00	2.50	114.2	105.0	*37,000	—	—	—
Canandaigua	Ontario	Tap, public supply	8/10/15	Tr	Tr.	2 v.	2 v.	175	35	140	.004	.046	.001	0.02	18.0	3.25	115.8	102.0	60	3+0—	1+2—	0+3—
Canandaigua	Ontario	Tap, public supply	8/10/15	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	60	1+2—	0+3—	0+3—
Canandaigua	Ontario	Tap, public supply	8/10/15	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	325	2+1—	0+3—	0+3—

* Delayed in transit.

CASTILE

HERMANN M. BIGGS, M. D., *State Commissioner of Health:*

A reinspection of the public water supply of Castile was made on July 15, 1915, by Dr. C. V. Patchin, sanitary supervisor, of District "L." A previous investigation of this supply was made in 1909 by the Engineering Division, the full report of which will be found on page 292, volume 2 of the thirtieth annual report of this Department.

The water supply of Castile is derived from springs located about three and one-half miles southwest of the village. These springs are located in rolling farm land which gradually slopes back to a level area, about 20 per cent. of which is wooded swamp. The water from these springs is collected in a concrete reservoir 60 feet in diameter and about 12 feet deep. There are about six springs which are connected with the reservoir. From the reservoir the water is distributed by gravity to the vilage. In addition to the springs and reservoir there are four wells constructed with concrete walls 7 feet in diameter and 10 feet deep which are connected directly to the distributing mains. In general the water works system remains the same as described in detail in the previous report.

The springs are protected from surface wash by concrete catch basins and the walls extend above the surface of the ground to prevent contamination. About one mile distant from the springs and wells and at an elevation of 50 or 75 feet is a large swamp containing about 200 acres. It is thought that this swamp is a source of the ground water which is collected by the springs and wells. There were no sources of human contamination within one-half mile of the swamp or springs.

At the time of the previous investigation a collecting well was located in the bed of a stream which received drainage from a hog-pen and manure pile on a steep slope a short distance above. Since the earlier investigation this spring has been abandoned.

At the time of this inspection Dr. Patchin collected samples of water from various points in the system and analyses of these samples together with others made in the past by the Division of Laboratories and Research will be found in the appended table.

These analyses show a supply practically colorless, clear and very hard. The figures for nitrogen in its various forms indicate moderate amounts of decomposing and decomposable organic matter. The figures for nitrates, however, are rather high and indicate the oxidization of considerable amounts of organic matter of vegetable or animal origin. The high nitrates are probably due to oxidation of organic matter derived from the swamp and from the fertilizers upon the cultivated farm lands on the watershed tributary to the springs. The bacterial counts are rather high for a noncontaminated ground water supply and the occasional occurrence of organisms of the B. coli type indicates a certain amount of active contamination at times, of human or animal origin. These results may be due to imperfectly purified surface water reaching the ground water tributary to the springs at times of heavy rainfall. In view of the absence of nearby sources of human contamination it is probable that this contamination is of animal rather than human origin.

In view of the above facts the following conclusions may be drawn:

1. That the village authorities of Castile have carried out the recommendations of this Department in respect to the abandonment of one of the springs tributary to their water supply which was open to contamination.

2. That the water supply of Castile is of a reasonably satisfactory sanitary quality, although from the analyses it is evidently subjected to occasional contamination which, from a consideration of the surroundings, is probably of animal origin.

I would, therefore, recommend:

1. That the village authorities make every effort to prevent the contamination of their springs by surface wash at times of rainfall.

It is, however, felt by the Water Board that the village is not in a position to carry out any of the above projects and is planning to begin operations toward increasing their present supply by pumping directly into the village mains from Cazenovia lake.

At the time of his inspection Dr. Brooks collected samples of water from various points in the system and the results of the analyses of these samples together with others made in the past by the Division of Laboratories and Research will be found in the appended table.

These analyses show a hard water, somewhat colored and at times turbid. The figures for nitrogen in its various forms are somewhat variable due doubtless to the varying proportion of surface and ground water present. The total baterial counts are usually high and at times excessive and fecal organisms of the B. coli type are present in the majority of the 10 c. c. inoculations and occasionally present in inoculations as small as 1/10 c. c. Such results indicate that the supply receives at times considerable contamination of animal or human origin.

In view of the above facts the above conclusions may be drawn:

1. That the present supply of Cazenovia derived from the impounding reservoir is of a reasonably satisfactory, sanitary quality although inadequate in quantity.

2. That the supply derived from the springs and well is undoubtedly open to serious contamination due to their location in a comparatively thickly settled neighborhood and improper protection from surface wash.

3. That any supply derived from Cazenovia lake should be subjected to some adequate form of water purification due to the numerous opportunities of contamination of the lake.

In view of the above facts I beg to submit the following recommendations:

1. That the village authorities give immediate attention to the recommendations of the earlier reports.

2. That the authorities abandon as soon as possible the present well and spring supply and secure a new supply adequate in quantity and of satisfactory sanitary quality.

3. That, in case an additional water supply is derived from Cazenovia lake the village install and operate some adequate method of purification.

Respectfully submitted,

THEODORE HORTON,
Chief Engineer

ALBANY, N. Y., *September* 15, 1915

Results of Water Analyses

Abbreviations used to describe odors of water: 0, none; 1, very faint; 2, faint; 3, distinct; 4, decided; 5, strong; 6, very strong; a, aromatic; d, disagreeable; e, earthy; f, fishy; g, grassy; m, musty; v, vegetable

Municipality	County	Source of sample	Date of collection	Physical				Chemical (Parts per Million)											Bacteriological			
						Odor		Solids			Nitrogen as—						Hardness			B. Coli Type + = present − = absent		
				Color	Turbidity	Cold	Hot	Total	Loss on ignition	Mineral residue	Free ammonia	Albuminoid ammonia	Nitrites	Nitrates	Oxygen consumed	Chlorine	Total	Alkalinity	Bacteria per c.c.; gelatin 20°, 48 hours	10 c.c.	1 c.c.	1-10 c.c.
Cazenovia	Madison	Tap, public supply	10/19/11	Tr.	10	....	....	202	21	181	.034	.112	.001	0.10	0.90	3.00	180.0	171.0	500	+	−	−
Cazenovia	Madison	Tap, public supply	11/15/11	10	3	....	....	302	38	264	.016	.058	.001	0.10	1.50	3.00	243.0	229.0	230	+	+	−
Cazenovia	Madison	Tap, public supply	12/29/11	Tr.	Cl.	....	....	262	26	236	.022	.030	.001	0.06	0.30	2.12	208.0	....	50	−	−	−
Cazenovia	Madison	Tap, public supply	2/ 7/12	Tr.	Cl.	....	....	222	26	196	.028	.052	Tr.	1.60	0.90	2.25	191.4	190.0	100	+	−	−
Cazenovia	Madison	Tap, public supply	3/18/12	5	10	....	....	268	35	233	.012	.026	.001	0.12	1.60	2.75	228.5	216.0	51,000	+	+	+
Cazenovia	Madison	Tap, public supply	4/27/12	10	10	....	....	247	29	218	.004	.066	.001	0.36	0.70	2.25	201.5	191.0	2,100	+	−	−
Cazenovia	Madison	Tap, public supply	9/25/12	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	1,300	+	+	−
Cazenovia	Madison	Tap, public supply	10/30/12	5	Tr.	....	....	275	30	245	.016	.030	Tr.	0.10	0.50	2.75	243.0	232.0	300	+	−	−
Cazenovia	Madison	Tap, public supply	11/27/12	5	Cl.	....	....	286	21	265	.014	.018	Tr.	0.02	0.40	2.25	257.0	223.0	70	−	−	−
Cazenovia	Madison	Tap, public supply	12/28/12	Tr.	Cl.	....	....	281	37	244	.014	.024	.001	0.02	0.80	2.25	228.5	226.0	10	−	−	−
Cazenovia	Madison	Tap, public supply	2/ 5/13	5	3	....	....	271	....	....	.024	.028	Tr.	0.02	0.50	2.75	243.0	226.0	10	−	−	−
Cazenovia	Madison	Tap, public supply	3/20/13	Tr.	2	....	....	270	....	....	.028	.012	Tr.	0.02	0.40	2.75	235.5	222.0	10	−	−	−
Cazenovia	Madison	Tap, public supply	5/14/13	Tr.	Cl.	....	....	273	....	....	.010	.008	.001	0.50	1.00	2.50	228.5	213.0	1,500	+	−	−
Cazenovia	Madison	Tap, public supply	6/18/13	5	Tr.	....	....	262	....	....	.010	.002	.001	0.20	0.30	2.00	221.5	222.0	750	−	−	−
Cazenovia	Madison	Tap, public supply	7/24/13	Tr.	Tr.	....	....	161	....	....	.006	.104	Tr.	0.24	1.00	2.00	142.8	131.0	120	+	+	−
Cazenovia	Madison	Tap, public supply	4/28/14	Tr.	2	1 a.	1 a.	164	22	142	.012	.054	.001	1.20	1.70	1.75	137.2	126.0	1,100	−	−	−
Cazenovia	Madison	Tap, public supply	8/ 4/15	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	100	3+0−	2+1−	0+3−
Cazenovia	Madison	Tap, public supply	8/ 4/15	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	1,400	3+0−	3+0−	1+2−
Cazenovia	Madison	Tap, public supply	8/ 4/15	Tr.	Tr.	1 v.	1 v.	346	95	251	.048	.038	.001	1.40	0.50	4.25	243.0	218.0	70	3+0−	3+0−	1+2−

CENTRAL ISLIP STATE HOSPITAL

Specifications for the installation of two deep wells, each approximately 800 feet deep, located at the Central Islip State Hospital were submitted by Hon. Lewis F. Pilcher, State Architect, on August 14, 1915. These specifications were approved by the Department on August 31, 1915.

CENTRAL VALLEY & HIGHLAND MILLS

HERMANN M. BIGGS, M. D., *State Commissioner of Health:*

A reinspection of the public water supply furnished by the Commonwealth Water Company to the villages of Central Valley and Highland Mills was made on June 5, 1915, by Dr. C. W. Berry, sanitary supervisor of District "N". A previous inspection of this supply was made by the Engineering Division in 1911, a full report of which will be found on page 716 of the thirty-second annual report of this Department.

The water supply is derived from Cromwell lake located in a depression between the mountains about two miles northwest of Central Valley. A supplementary supply, used at intervals, is derived from Earle's pond, an artificial pond formed by constructing a dam across the outlet of a small mountain brook.

At Cromwell lake the intake is on the east shore where there are two pipes extending 35 and 50 feet into the lake. Through these intakes, the water flows into a masonry chamber 12 by 20 feet in plan in which are several vertical screens having a 3/16-inch mesh. During the summer months, the water from Cromwell lake is passed through a filter constructed as follows: An uncovered concrete tank 80 by 100 feet in plan and about 20 feet high is divided into two compartments with an arrangement of valves so that the water can be diverted into either or both chambers. Over the floor are tile underdrains covering which there is a layer of coarse gravel and on top of the gravel a layer of fine sand, the thickness of the sand and gravel layers together being about 2½ feet. After passing through the filter, the water is collected in a clear water basin 15 by 40 feet in plan from which it passes directly into the mains.

Earle's pond is about 500 feet wide by 1,500 feet long with an average depth of 6 feet. The masonry dam is 460 feet long and 35 feet high at its highest point and was constructed in 1912 and 1913. The water from this pond has been used very little as yet on account of the disagreeable color and odor. There is a concrete intake connected directly with a 12-inch main leading to the village. This intake is protected by a ⅛-inch mesh screen.

The water from both sources is delivered by gravity through about ten miles of cast-iron pipe ranging in size from 2 to 12 inches in diameter. There are nearly 350 service taps of which a few only are metered. The water pressure in the village is 140 to 150 pounds per square inch from the Earle's pond supply and 110 pounds from the Cromwell lake supply. The Commonwealth Water Company of New York, of which Mr. W. M. Imbrie is president, with offices at 45 Broadway, New York City, owns and operates the water works.

At different times during the year, an attempt is made to treat the supply with hypochlorite of lime. Two tanks, each holding 60 gallons, are filled with a solution of bleach, which is slowly discharged into the supply as it enters the mains. There is no way of measuring or knowing just what amounts are used or of properly adjusting the treatment to secure an even distribution of the bleach. For the present, this sterilization has been discontinued. Once a year, the waters of the lake are treated with copper sulphate in order to destroy growths of algae. About 300 pounds of the chemical are used at one time by the usual method of drawing a bag full of copper sulphate from the stern of a boat rowed around the lake. Amended rules and regulations for the sanitary protection of this water supply were enacted by this Department on March 5, 1913.

This water supply has been under investigation by this Department at numerous times in the past. In 1907, an outbreak of typhoid fever was attributed to contamination of the lake water. In 1908, an inspection disclosed the existence near the lake of violations of the rules and regulations and the full investigation of 1911 indicated that the public water supply was the most probable cause of several cases of typhoid fever that had occurred at that time. The report on the 1911 investigation pointed out that the conditions on the lake watershed had been and continued to be a serious menace to the health of the water users. It was, therefore, recommended that the Commonwealth Water Company be urged to proceed at once to correct the insanitary conditions affecting the public water supply of the village, described above, by:

1. Removing all privies, cesspools, sink and laundry waste outlets to a reasonable distance from the lake as indicated and as required by the rules and regulations for the protection from contamination of the public water supply of the villages of Highland Mills and Central Valley.
2. By the installation of artificial sand filters, where necessary because of the unsuitability of the subsoil for cesspools, for the purification of sewage and contaminated water before passing into the lake.
3. That the water company safeguard the public water supply from Cromwell Lake by extending the intake into the deeper water and the installation of some approved, permanent and efficient plant to be efficiently operated for the purification of the water supply derived from the lake.
4. That the water company apply to this Department for the amendment of the rules and regulations to apply to the watershed of the Schunemunk mountain stream and other sources of public water supply for these villages.

It would appear that the water company has carried out more or less thoroughly the recommendations of this Department although the efficiency of the so-called filtration plant and sterilization apparatus is somewhat doubtful.

The watershed area tributary to Cromwell Lake is 345 acres. Upon this area there are about five summer dwellings with accompanying privies and cesspools and, in addition to the possible contamination from such permanent sources, there is also the contamination incident to the use of the lake and its shores for pleasure purposes.

The Earle's pond supply has a watershed area of about 200 acres comprising a portion of the side slope of Schunemunk mountain, this area being uninhabited and owned by the water company.

At the time of the inspection, samples of water were taken from both sources of supply and the results of the analyses of these samples together with others made in the past by the Division of Laboratories and Research will be found in the appended table.

These analyses show a soft water, somewhat colored and occasionally slightly turbid. The total bacterial counts are at times somewhat high even for a surface supply and the occasional occurrence of organisms of the B. coli type indicates a certain amount of contamination of human or animal origin. The analyses made since 1912 indicate a somewhat better bacterial quality than in earlier years. The high counts of the samples taken at the time of the reinspection are probably due to the multiplication of bacteria in transit owing to the melting of the ice in the sample containers.

In view of the above facts, the following conclusions may be drawn:

1. That the Commonwealth Water Company has carried out to some extent the recommendations of this Department.
2. That the water supply derived from Cromwell Lake is still open to contamination from permanent sources and also to accidental, incidental or wilful contamination due to the use of this lake and its vicinity for pleasure purposes.

3. That the Earle's pond supply is open to objection from an esthetic standpoint due to high color and disagreeable tastes and odors originating from the decay of vegetable organic matter and the resultant growth of algae.

4. That the filter from the Cromwell Lake supply is probably of low and unreliable efficiency and the method by which the hypochlorite has been applied to the filtered water is such as to render little, if any, benefit.

I would, therefore, recommend:

1. That the water company continue to exercise the utmost diligence in enforcing the rules and regulations enacted by this Department for the sanitary protection of their water supply.

2. That the water company supplement the filtration of the Cromwell Lake supply by sterilization with liquid chlorine.

3. That the water company make a study of the possibility of improving the esthetic quality of the Earle's pond supply either by removing the organic deposits from the bottom of this pond or by treating the water with copper sulphate in a manner similar to that employed at Cromwell Lake.

Respectfully submitted,

THEODORE HORTON,

Chief Engineer

ALBANY, N. Y., *August* 10, 1915

RESULTS OF WATER ANALYSES

Abbreviations used to describe odors of water: 0, none; 1, very faint; 2, faint; 3, distinct; 4, decided; 5, strong; 6, very strong; a, aromatic; d, disagreeable; e, earthy; f, fishy; g, grassy; m, musty; v, vegetable

Municipality	County	Source of sample	Date of collection	PHYSICAL				CHEMICAL (PARTS PER MILLION)											BACTERIOLOGICAL			
						ODOR		SOLIDS			NITROGEN AS—						HARDNESS			B. COLI TYPE + = PRESENT — = ABSENT		
				Color	Turbidity	Cold	Hot	Total	Loss on ignition	Mineral residue	Free ammonia	Albuminoid ammonia	Nitrites	Nitrates	Oxygen consumed	Chlorine	Total	Alkalinity	Bacteria per c.c.; gelatin 20°; 48 hours	10 c.c.	1 c.c.	1-10 c.c.
Central Valley	Orange	Tap, public supply	10/26/11	10	Tr.	....	....	67	23	44	.010	.090	.001	0.20	1.50	3.12	26.0	15.0	300	+	+	—
Central Valley	Orange	Tap, public supply	12/ 8/11	10	Cl.	....	....	36	10	26	.022	.150	.001	0.10	1.60	2.50	16.9	13.0	50	+	—	—
Central Valley	Orange	Tap, public supply	1/25/12	5	Cl.	....	....	35	7	28	.014	.098	.001	0.10	1.40	3.25	22.1	10.0	20	—	—	—
Central Valley	Orange	Tap, public supply	10/ 3/12	10	5	....	....	49	19	30	.008	.120	Tr.	0.06	2.10	3.00	26.0	17.0	18,000	+	+	—
Central Valley	Orange	Tap, public supply	3/14/13	5	Tr.	....	....	41	....	....	.028	.096	Tr.	0.04	1.80	2.00	12.7	10.0	20	—	—	—
Central Valley	Orange	Tap, public supply	4/17/13	10	2	....	....	39	....	....	.032	.098	.001	0.04	3.10	1.75	20.8	10.0	400	—	—	—
Central Valley	Orange	Tap, public supply	7/10/13	7	2	....	....	47	....	....	.004	.108	.001	0.04	1.60	2.25	22.1	15.0	......	—	—	—
Central Valley	Orange	Tap, public supply	3/24/14	5	Tr.	1 v.	1 v.	52	18	34	.058	.126	.004	0.16	3.20	2.75	22.1	8.0	650	1+2—	0+3—	0+3—
Central Valley	Orange	Tap, public supply	6/ 5/15	15	2	3 v.	3 v.	48	27	21	.014	.180	.001	0.02	5.60	1.25	18.2	5.0	*1,600	0+3—	0+3—	0+3—
Central Valley	Orange	Cromwell lake	......	Tr.	Tr.	1 v.	1 v.	46	6	40	.022	.110	.001	0.06	4.65	2.00	23.4	11.0	500	2+1—	0+3—	0+3—
Central Valley	Orange	Earle's pond	......	15	Tr.	1 v.	1 v.	43	9	34	.012	.148	.001	0.02	6.25	0.75	11.1	5.0	*1,100	1+2—	1+2—	0+3—

* Ice melted.

CHAMPLAIN

HERMANN M. BIGGS, M.D., *State Commissioner of Health*:

A reinspection of the public water supply of Champlain was made October 22, 1914, by Dr. John A. Smith, sanitary supervisor of district "A" and the following facts are based upon information furnished by him. The previous report of a full investigation of this supply made by the Engineering Division in 1912 will be found on page 645 of the thirty-third annual report of this Department.

The water supply of this village is derived from the Big Chazy river at a point 1½ miles above the center of the village. The location of the intake, pumping equipment and the water supply system in general remain practically the same as at the time of the previous inspection. The population of Champlain is about 1,500 and the daily water consumption is approximately 70,000 gallons. The water works are owned and operated by the village.

The watershed of the Big Chazy river above Champlain has an estimated area of 260 square miles. Upon this area are the hamlets of Altona, Ellenburg, Ellenburg Center, Ellenburg Depot, Perry Mills, Mooers Forks and the village of Mooers. These communities are located upon the river and its tributaries and have a total population of about 3,500. The total population in the watershed is estimated at 8,500, giving an average population per square mile of approximately 33.

There are several opportunities for pollution within a short distance upstream from the pumping station. A short distance above the pumping station the canal from which the water supply is taken, is twice crossed by the Rutland R. R. and no effort has been made to protect the supply from contamination from this source. About two miles above the pumping station is the hamlet of Perry Mills in which there are some 7 or 8 houses containing from 4 to 6 persons each. There is no public or private sewer system in this hamlet. Each house has a privy and each of these privies is within 50 feet of the river towards which the ground slopes very abruptly. At this point there is a saw mill from which saw dust is frequently blown into the river by the wind.

About 10½ miles above the pumping station is the village of Mooers having a population of 550 with no public water supply or sewer system. The D. & H. R. R. crosses the river here on an open floor plate girder bridge allowing opportunity for pollution of the stream from the passenger coaches. About one-quarter of a mile above the railroad bridge on the left bank of the river is a mill, at which there is a privy located directly over the tail race. Adjacent to the mill on the east river bank which is high and steep, there was located a manure dump at the time of the inspection and just east of this the cemetery spoken of in the former report. About 1,000 feet east of the grist mill is a 4-inch vitrified drain pipe which discharges into a cesspool which takes care of the sewage of four houses. This cesspool seeps out onto a flat about 150 feet from the river. Fifty feet further east is a large 8-inch pipe leading from a butter factory, which, however, was not in operation at the time of the inspection. Still further east located between a spur and the main branch of the D. & H. R. R. a 6-inch vitrified pipe which carries the sewage of one family, discharges into the river. Just east of this is another 4-inch pipe which is connected with the sewers from two other houses and which also drains into the river. At a shirt factory in the village of Mooers there are located two flush closets draining into the river. At the time of the inspection this factory was not in operation.

In addition to these specific points of pollution, there are probably 25 houses in each of the towns of Altona and Ellenburg having sewers emptying into or cesspools near the Big Chazy river or one of its branches. There is also opportunity for contamination of animal origin from cattle pastured along the shores of these streams and by drainage from road wash.

The early report pointed out clearly the many opportunities for direct, intermittent and dangerous pollution from the comparatively large population resident upon the watershed and from the railroad trains at the

various points where the railroad crosses the water courses above the pumping station. It was also the conclusion of this earlier report that the evidence showed that the pollution of the river was of such intensity as to make the supply unsafe for domestic use and made the following recommendations:

1. That the Board of Water Commissioners of the village make a thorough study of the watershed of the Big Chazy river above Champlain with a view of determining the economy and practicability of removing all direct and dangerous sources of polluton from the public water supply.

2. That should it prove practicable and in accordance with economy to reduce this pollution to a minimum, the water commissioners apply to this Department for the enactment of rules and regulations for the sanitary protection of the water supply.

3. That should it be entirely impracticable to entirely remove the dangerous pollution of this water shed, that the water be subjected to some process of purification such as slow sand filtration or other approved method of filtration.

4. That the present intake be changed so that the supply will be derived from the northerly canal above the Rutland railroad crossing in such a way as to avoid the danger of pollution from the trains now passing directly above the intake.

It appears then from Dr. Smith's report that none of these recommendations have been carried out nor does it appear that consideration has been given to any save, possibly, the relocation of the intake.

At the time of his inspection samples of water were collected by Dr. Smith from the various points in the river and from the public water supply of Champlain and the results of the analyses of these samples together with others made by the Division of Laboratories and Research since the previous investigation will be found in the appended table.

These analyses show a water rather high in color, somewhat turbid at times and moderately hard. The total number of bacteria are usually excessive even for a surface supply and the occurrence of organisms of the B. coli type in inoculations as small as 1/10 c. c. indicates active and somewhat concentrated contamination by excrement from human and animal sources. The samples collected by Dr. Smith show that the most active contamination at the time of his inspection was just below the village of Mooers.

In view of the above facts, the following conclusions may be drawn:

1. That the village authorities have apparently made no attempt to carry out the recommendations of the previous report.

2. That the sanitary quality of the raw water of the Big Chazy river is decidedly unsatisfactory, due not only to the pollution of this stream incidental to the large resident population upon the watershed but also to many instances of direct sewage contamination.

3. That this insanitary condition of the public water supply of Champlain is a constant menace to the health of this village and may at any time result in a serious outbreak of typhoid fever.

I would, therefore, recommend that the village authorities be requested to take the following steps to improve the sanitary quality of their water supply:

1. Extend the water works intake above the railroad crossing as recommended in the previous report.

2. Install as soon as possible some modern method of filtration supplemented by sterilization.

3. Install immediately, pending permanent improvement, some form of sterilization apparatus, using either hypochlorite of lime or liquid chlorine with a view of such method being available for supplementary treatment after the installation of a filter plant.

Respectfully submitted,

THEODORE HORTON,
Chief Engineer

ALABANY, N. Y., *March* 18, 1915

RESULTS OF WATER ANALYSES

Abbreviations used to describe odors of water: 0, none; 1, very faint; 2, faint; 3, distinct; 4, decided; 5, strong; 6, very strong; a, aromatic; d, disagreeable; e, earthy; f, fishy; g, grassy; m, musty; v, vegetable

Municipality	County	Source of sample	Date of collection	Physical				Chemical (Parts per Million)												Bacteriological			
						Odor		Solids			Nitrogen as—						Hardness			B. Coli Type + = present — = absent			
				Color	Turbidity	Cold	Hot	Total	Loss on ignition	Mineral residue	Free ammonia	Albuminoid ammonia	Nitrites	Nitrates	Oxygen consumed	Chlorine	Total	Alkalinity	Bacteria per c.c.; gelatin 20°; 48 hours	10 c.c.	1 c.c.	1-10 c.c.
Champlain	Clinton	Tap, public water supply	9/ 2/12	30	Tr.	....	....	140	31	109	.002	.080	Tr.	0.06	4.50	0.50	52.9	51.0	51,000	+	—	—
Champlain	Clinton	Tap, public water supply	12/ 5/12	50	10	....	....	69	26	43	.020	.188	Tr.	0.20	12.4	1.00	37.7	26.0	8,300	+	+	+
Champlain	Clinton	Tap, public water supply	10/12/14	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	1,000	3+0—	1+2—	0+3—
Champlain	Clinton	Intake, public water supply	10/12/14	18	Tr.	1 v.	1 v.	93	25	68	.014	.082	.001	0.02	4.40	0.88	60.0	60.0	1,400	3+0—	3+0—	0+3—
Champlain	Clinton	Big Chazy R. at Perry Mills	10/12/14	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	150	2+1—	0+3—	0+3—
Champlain	Clinton	Big Chazy R. at Mooers	10/12/14	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	1,400	3+0—	3+0—	2+1—

CINCINNATUS

HERMANN M. BIGGS, M.D., *State Commissioner of Health:*

A reinspection of the water supply of Cincinnatus was made on November 30, 1915, by Dr. Paul B. Brooks, sanitary supervisor of District "D." A previous investigation of this supply was made by the Engineering Division in 1912, a full report of which will be found on page 648 of the thirty-third annual report of this Department.

The public water supply is obtained from a number of springs located on a spur of the mountains about three or four miles southwest of the village. The description of these springs and the water works system in general remains practically the same as given in detail in the previous report. The water works are owned and operated by the village.

At the time of the previous report it was pointed out that the sanitary quality of the supply derived from these springs was endangered by pollution from manured fields, poultry houses, and possibly from leachings from a nearby farmhouse privy and from a certain amount of animal and human organic matter incidental to the occupation by men and animals of the territory adjacent to the springs. Therefore the following recommendations were made:

1. That should the board of water commissioners retain the present source of public water supply, that the danger of pollution of this supply be prevented by:

(a) Elimination of all the sources of contamination of the springs, as indicated in the above report, or their removal to such distances from the springs as to preclude any pollution of the supply.

(b) Construction of trenches of ample dimensions along the side of the hill above the springs at such a grade as to effectually prevent the flow of storm water over the springs and pipe lines leading to the catch basins.

(c) Raising the masonry of the catch basins and springs to at least 18 inches above the surface of the ground and providing them with water-tight properly ventilated covers.

2. That should these improvements prove uneconomical or impracticable the board of water commissioners seek another source of public water supply which shall be free from the danger of direct or accidental pollution and adequate in quantity for the future needs of the village.

3. That regular and frequent inspections be made by those in charge of all parts of the water works to prevent accidental or wilful pollution of the water supply.

It appears from the report of Dr. Brooks, as well as from correspondence with the local authorities, that the farm noted in the earlier report as being a possible source of contamination of the supply has been purchased by the village. This farm was vacated early last summer and some steps have been taken by the water commissioners towards the removal of the farm buildings. These buildings have been sold and the sale of others is pending, but none of them as yet has been actually removed from the farm. None of these buildings however is occupied and none of them except the henhouse is located above the springs. There is also an old manure heap at a distance of perhaps 50 feet from one of the lower springs but at a lower elevation. The land on the watershed above the springs is meadow land and has not been cultivated this past summer.

A letter from this Department earlier in the year made the following suggestions to the village authorities for the adequate protection of the springs:

1. Remove all structures, such as henhouses, sheds, etc., now located above the springs from which drainage may reach the springs, and also remove all accumulations of manure or other organic matter which may be similarly located.

2. Remove the privy and contents located near the line of tile from the westerly catch basin.

3. Allow no structure to remain below the springs or line of tile at any point from which drainage might reach the springs.
4. Abandon the cultivation of land above the springs from which pollution of the ground water might occur.
5. Construct trenches of ample dimensions along the side of the hill above the springs at such a grade as to effectually prevent the flow of storm water over the springs and pipe lines leading to the catch basins.
6. Raise the masonry of the catch basins and springs at least 18 inches above the surface of the ground and provide them with watertight and properly ventilated covers.
7. Fence off the area upon which the springs are located so that the fence will be at no point nearer than 50 feet to any of the springs.
8. Forbid all trespassing upon the area thus enclosed and allow no one to enter this enclosure except duly authorized employes of the water board in the carrying out of their duties.

From the report of Dr. Brooks it appears that, although these recommendations have not as yet been carried out, it is the intention of the village authorities to give them early consideration.

At the time of his inspection Dr. Brooks collected samples of water and the results of the analyses of these samples together with others made in the past by the Division of Laboratories and Research will be found in the appended table.

These analyses show a water practically clear, colorless and fairly soft. The figures for free and albuminoid ammonia and nitrites indicate very moderate amounts of decomposing and decomposable organic matter. The nitrates and chlorine, however, are somewhat high, indicating the occurrence of organic contamination of the ground water sources, well oxidized by passage through the soil. The bacterial counts are low in the samples collected at the time of the recent inspection and organisms of the B. coli type were absent in 30 c.c. samples. Analyses of earlier samples, however, showed the occurrence of a certain amount of active contamination and the satisfactory results obtained from the recent samples would indicate that the removal of the nearby sources of contamination has been of value in protecting the sanitary quality of the supply.

In view of the above facts the following conclusions may be drawn:

1. That the village authorities of Cincinnatus have in part carried out the previous recommendations of this Department.
2. That there remains, however, the need for certain improvements as detailed at length in our letter of May 17, 1915.

I would therefore recommend:

1. That the village authorities take steps to carry out at the earliest possible moment the improvements previously suggested in detail by this Department for the adequate sanitary protection of their water supply.

Respectfully submitted,

THEODORE HORTON,
Chief Engineer

ALBANY, N. Y., *December* 21, 1915

REPORT OF WATER ANALYSIS FOR CINCINNATUS

Source	Tap	Tap	Tap	Tap	Spring
Collected on	12/4/14	12/4/14	12/4/14	11/30/15	11/30/15
Color	Trace	....	....	5	....
Odor, hot	1 v	....	....	1 v	....
Odor, cold	1 v	....	....	1 v	....
Turbidity	Trace	....	....	5	....
Solids, total	91	....	....	83	....
Loss on ignition	15	....	....	23	....
Mineral residue	76	....	....	60	....
Ammonia, free	.002	....	....	.010	....
Ammonia, albuminoid	.004	....	....	.014	....
Nitrites	.001	....	....	.001	....
Nitrates	0.70	....	....	2.00	....
Oxygen consumed	0.90	....	....	1.00	....
Chlorine	1.50	....	....	1.25	....
Hardness, total	54.3	....	....	36.4	....
Alkalinity	51.0	....	....	32.0	....
Bacteria per c.c.	60	50	50	15	15
B. coli type, 10 c.c.	+	+	+	—	—
B. coli type, 1 c.c.	—	—	—	—	—
B. coli type, 1/10 c.c.	—	—	—	—	—

Results are expressed in parts per million: + Present. — Absent.
Abbreviations used to describe odors of water: 0, none; 1, very faint; 2, faint; 3, distinct; 4, decided; 5, strong; 6, very strong; a, aromatic; d, disagreeable; e, earthy; f, fishy; g, grassy; m, musty; v, vegetable.

CLAYTON

HERMANN M. BIGGS, M. D., *State Commissioner of Health:*

A reinspection of the public water supply of Clayton was made on July 27, 1915, by Dr. B. R. Wakeman, sanitary supervisor of District "B". A previous inspection of this supply was made in 1909 by the Engineering Division in connection with an investigation of an outbreak of typhoid fever. A full report of this earlier investigation will be found on page 472, volume 2 of the thirtieth annual report of this Department.

Clayton is an incorporated village with a population of about 2,000, located in the northwestern part of Jefferson county on the St. Lawrence river. The public water supply of this village is derived from the St. Lawrence river and is pumped directly into the distribution system against the head maintained by a standpipe in the southern section of the village. The intake consists of a 12-inch line of pipe extending into the river 600 feet from the shore line to a point where the depth is about 60 feet. The water works system remains practically the same as described in the previous report.

The opportunities for pollution of the St Lawrence river were enumerated in detail in the earlier report. Further data in regard to the intensity of contamination of the river will be found in the report of the Engineering Division upon the quality of water in the St. Lawrence river, given on page 1,072 of the thirty-second annual report of this Department. The following conclusions taken from this latter report summarize the findings of the Department in respect to the sanitary quality of river water:

1. That the sewage which reaches the lower end of Lake Ontario and pollutes the upper reaches of the St. Lawrence river is so highly diluted as not to be distinguished readily by the chemical analyses but is shown in a clearly definite way by the bacteriological tests.

2. These bacteriological tests show by the count as well as the presence of B. coli that the pollution of the river becomes more intense the further down we travel from the head of the lake, the samples opposite Clayton showing generally considerable more pollution than the samples at the lower end of the lake.

3. That there is no marked horizontal stratification of the pollution due to its hugging the shores on the American sides except near Clayton where it is very marked.

4. That with respect to seasonal variation of this pollution the different series of analyses indicate that the pollution is in occurrence of B. coli more intense in the summer season than at other seasons of the year. This is especially marked and obvious in the August 21 and 22, 1911 series, which were taken at the time when the summer population was more active through the Thousand Islands and along the shores than at other seasons of the year.

5. That in considering the apparent absence of pollution during the colder seasons of the year at all the ranges, based on B. coli, due allowance must be made of the unfavorable environment for these organisms at this season and that atypical forms, which may not respond to laboratory tests, may be present. If this allowance is made the conclusions as above expressed are strengthened.

6. That the pollution of the St. Lawrence river as evidenced by the series of analytical data herewith presented explains very clearly the increased prevalence of typhoid fever which has occurred at Clayton, Alexandria Bay and other places along the shores or among the Thousand Islands where water supplies have been taken directly from the St. Lawrence river without purification.

7. That, whereas pollution discharged into this river is highly diluted as a result of the large volume of flow of the river and would for this reason tend to lessen any infection from this source, the rapid flow of the river tends to carry this infection quickly to sources of consumption and renders it of probably greater virulence. In other words the apparent immunity one might expect resulting from this great dilution is largely counteracted by the virulence of the pollution and it is probable that this virulent infectious material, though small in amount as a result of high dilution, is the cause of the persistent prevalence of typhoid fever among the communities and residents who drink or bathe in these waters.

In the 1909 report it was pointed out that further local contamination to the Clayton supply might be brought about through a break or leak in the intake pipe through which pollution and possibly infection might reach the supply from the pollution existing near the shore. In this connection it was noted that the intake line paralleled for about 75 feet the main outlet sewer of the village which was laid about 3 feet down the stream and slightly higher than the intake pipe.

It was the conclusions of this 1909 report that the evidence pointed strongly to the water supply as source of the typhoid outbreak at that time and it was, therefore, recommended:

1. That the previous warning to the public to boil all water should be strictly observed and continued until adequate and efficient means are adopted and carried out by the village authorities for furnishing a pure and safe water supply for the village by either securing a new raw supply from an unpolluted source or by efficient purification of their present supply.

2. That if after careful cosideration of the various means of securing a pure supply it is considered expedient to purify the present supply taken from the St. Lawrence river, it is highly desirable, if not necessary, to change the arrangement of the present water supply intake and the main sewer outlet. Owing to the fact that the outlet sewer is under a vacuum condition and that the intake main sewer is under a plenum condition, there will always be a manacing probability of an infection of water in the intake and as a consequence the outfall sewer should be carried to a new discharge point entirely away from the intake and at a point well down stream and all sewer outlets from the village above the intake should be intercepted and the sewage carried well below the intake.

It was also suggested that the supply be sterilized temporarily with hypochlorite of lime.

From the report of Dr. Wakeman upon his reinspections it appears that none of these recommendations have been carried out, although the local authorities seem desirous of improving the supply and are considering sterilization with liquid chlorine.

At the time of his inspection Dr. Wakeman collected samples of water at various points in the St. Lawrence river and from a tap in the village and the results of the analyses of these samples together with others made in the past by the Division of Laboratories and Research will be found in the appended table.

These analyses show that the St. Lawrence river water is very hard, practically colorless and free from turbidity. The amount of organic matter of vegetable or animal origin is very low due to the fact that the high dilution to which the contamination is subjected renders it practically impossible to detect its presence by chemical tests. As a rule, however, the bacterial counts are rather high and organisms of the B. coli type are moderately prevalent, indicating active contamination.

In view of the above facts the following conclusions may be drawn:

1. That the village authorities have not as yet carried out the recommendations of this Department, although consideration is now being given to sterilization with liquid chlorine.

2. That although the water supply derived from the St. Lawrence river is reasonably satisfactory from an esthetic standpoint, it is extremely unsatisfactory from a sanitary standpoint due to the continuous sewage contamination of the St. Lawrence river.

3. That the continued use of the impure river water for drinking or culinary purposes leaves the village open to the recurrence of outbreaks of typhoid fever.

4. That in view of the recent improvements in the methods of sterilization of water supplies by liquid chlorine and in view of the fact that the river water is of a fairly constant quality, it would seem perfectly feasible for the village to install such apparatus and thereby secure a method for rendering their supply safe.

I would therefore recommend:

1. That the earlier recommendations of this Department in regard to the changing of the location of the sewer be carried out by the village authorities.

2. That the village install at once modern apparatus for the sterilization of the supply by liquid chlorine. In case this apparatus is installed it should be at all times carefully and efficiently operated and if possible under the supervision of a competent expert.

Respectfully submitted,

THEODORE HORTON,
Chief Engineer

ALBANY, N. Y., *September* 20, 1915

RESULTS OF WATER ANALYSES

Abbreviations used to describe odors of water: 0, none; 1, very faint; 2, faint; 3, distinct; 4, decided; 5, strong; 6, very strong; a, aromatic; d, disagreeable; e, earthy; f, fishy; g, grassy; m, musty; v, vegetable

Municipality	County	Source of sample	Date of collection	Physical				Chemical (Parts per Million)											Bacteriological			
						Odor		Solids			Nitrogen as—						Hardness			B. Coli Type (+ = present, — = absent)		
				Color	Turbidity	Cold	Hot	Total	Loss on ignition	Mineral residue	Free ammonia	Albuminoid ammonia	Nitrites	Nitrates	Oxygen consumed	Chlorine	Total	Alkalinity	Bacteria per c.c.; gelatin 20°; 48 hours	10 c.c.	1 c.c.	1-10 c.c.
Clayton	Jefferson	Tap, public supply	9/27/10	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	50	+	—	—
Clayton	Jefferson	Tap, public supply	9/27/10	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	60	+	—	—
Clayton	Jefferson	Tap, public supply	3/14/11	2	5	....	....	142	22	120	.022	.034	.001	0.10	2.30	7.25	102.8	99.0	1,100	+	+	—
Clayton	Jefferson	Tap, public supply	7/ 3/11	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	3,200	+	—	—
Clayton	Jefferson	Tap, public supply	7/ 3/11	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	5,600	+	—	—
Clayton	Jefferson	Tap, public supply	7/ 3/11	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	7,200	—	—	—
Clayton	Jefferson	Tap, public supply	10/ 9/11	Tr.	1	....	....	130	17	113	.006	.052	.001	0.40	1.10	7.00	100.0	95.0	600	+	+	—
Clayton	Jefferson	Tap, public supply	4/20/12	5	Cl.	....	....	141	21	130	.008	.048	.003	0.08	1.50	6.75	102.8	93.0	50	+	+	—
Clayton	Jefferson	Tap, public supply	6/11/12	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	30	+	—	—
Clayton	Jefferson	Tap, public supply	11/20/12	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	400	+	—	—
Clayton	Jefferson	Tap, public supply	11/20/12	5	Tr.	....	....	147	20	127	.010	.088	.001	0.06	2.10	7.75	111.4	96.0	300	—	—	—
Clayton	Jefferson	Tap, public supply	3/29/12	5	Tr.	....	....	131	....	....	.006	.048	Tr.	0.14	1.00	7.00	114.2	93.0	475	+	—	—
Clayton	Jefferson	Tap, public supply	5/10/13	1	Cl.	....	....	140	....	....	.004	.050	.001	0.10	1.40	6.75	95.7	92.0	750	—	—	—
Clayton	Jefferson	Tap, public supply	6/21/13	Tr.	Tr.	....	....	144	....	....	.004	.064	.001	0.06	1.50	7.75	97.2	91.0	30	+	—	—
Clayton	Jefferson	Tap, public supply	7/24/13	Tr.	Tr.	....	....	155	....	....	.006	.068	.001	0.06	1.00	7.50	94.2	92.0	70	+	+	—
Clayton	Jefferson	Tap, public supply	5/15/14	5	Tr.	2 v.	2 v.	140	20	120	.016	.086	.001	0.10	2.00	8.00	97.2	92.0	150	—	—	—
Clayton	Jefferson	St. Lawrence river over intake	7/27/15	Tr.	Tr.	2 v.	2 v.	162	41	121	.002	.028	.001	0.08	2.10	9.00	102.8	92.0	650	3+0—	0+3—	0+3—
Clayton	Jefferson	St. Lawrence river 100 feet from shore	7/27/15	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	100	3+0—	0+3—	0+3—
Clayton	Jefferson	Pumping station	7/27/15	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	900	3+0—	2+1—	0+3—
Clayton	Jefferson	Tap, public supply	7/27/15	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	950	2+1—	1+2—	0+3—

COBLESKILL

HERMANN M. BIGGS, M.D., *State Commissioner of Health:*

An investigation of the public water supply of the village of Cobleskill was made on March 23, 1915.

Cobleskill is an incorporated village with a population of about 2,000 located in the northwestern part of Schoharie county, 45 miles west of Albany on the D. & H. R. R. The surrounding country is a farming and dairying section for which the village is the trading center and shipping point for dairy products.

The public water supply of Cobleskill is derived from a small stream impounded in a storage reservoir about two miles southeast of the village. The original waterworks system was designed by W. M. Roberts, C.E., and constructed under his direction in 1887. During the past year pressure mechanical filters have been installed under the direction of Vrooman & Perry, consulting engineers.

It is estimated that 1,800 people are served by this supply or 90 per cent. of the total population and the average daily water consumption is given as 45,000 gallons. There are six miles of cast-iron water mains ranging in size from 4 to 20 inches in diameter. Of the 400 service taps none are metered. Distribution is by gravity under a pressure of about 90 pounds per square inch. The waterworks are owned and operated by the village under the direction of the board of water commissioners of which Mr. James L. Fuller is president and Mr. George Van Buren, superintendent.

The storage and distribution reservoir consists of a partly artificial pond of 28 acres surface area averaging 11 feet deep but having a depth of 24 feet at the gate house. This reservoir was formed by an earthenwork dam, the site excavated and low dikes formed around its perimeter. The whole is lined with clay and riprap. The reservoir capacity is estimated at 110,000,000 gallons.

The intake is located some 25 or 30 feet from the northern shore of the reservoir. This intake consists of a brick masonry gate-house in which there is a central well 26 feet deep extending some 2 feet below the bottom of the reservoir. There are four intake pipes leading from the reservoir into this gate-house located approximately 4, 8, 11 and 14 feet above the bottom of the reservoir. In this chamber there is a crude gravel strainer which it is expected, will be removed this coming summer. A mud pipe for draining the reservoir at times of cleaning and an overflow pipe are also provided.

From the intake at the reservoir the water flows by gravity through about two miles of cast-iron mains to the filters located in the southeastern part of the village. The purification plant consists of four cylindrical pressure mechanical filters housed in a substantial brick building. These filters which were constructed and designed by the International Filter Co., are vertical shells of steel, 92 inches in diameter, about 7 feet high and containing 26 inches of Cape May filter sand over 10 inches of graded gravel. The underdrain system of each filter consists of 132 brass strainers connected with a collection system of lateral pipes leading to the main effluent pipe which in turn discharges into the main leading to the village.

Sulphate of aluminum is used as a coagulant and when necessary soda ash is applied to the raw water in order to increase its alkalinity. Both chemicals are applied by means of the "shunt" system. There are two small iron cylinders connected with the raw water influent pipe by means of small brass pipes. These cylinders are filled with the respective chemicals, closed tightly and a small amount of raw water by-passed through them. The by-passing of this small amount of water is designed to slowly dissolve the chemicals and carry them in solution to the raw water just before it enters the filters. The amount of chemicals dissolved can be controlled by valves which determine the quantity of raw water by-passed. The exact amount of chemicals used is not known although it is estimated that about one-half grain of alum per gallon of water is being used. The single set of analyses available would indicate that at the time of the inspection little or no alum was being applied to the raw water, this being shown by the fact that the filtered water contained slightly more alkalinity than the raw water. If the alum was being applied in any quantity the reverse would be true.

With a daily water consumption of 45,000 gallons, the rate of filtration is approximately 10,000,000 gallons per acre per day. This rate is low for a mechanical filter but is none too low when insufficient coagulation takes place. The filters are cleaned every day by reverse flow, one filter being washed at a time. The inlet valve in the raw water main is closed, the waste water valve to the sewer is opened and the filtered water from the other three filters passes up through the filter and then flows off to the sewer, carrying with it the dirt collected in the filter sand. Each filter is washed until the waste water runs clear, this requiring in the neighborhood of 10 minutes but the amount of waste water used is unknown. The operation of the filters and the inspection of the reservoir and watershed is carried out by the superintendent.

The investigation of this water supply was made by Mr. E. S. Chase, assistant engineer in this Department, following the receipt of a request from the superintendent of the waterworks for such an inspection. The assistant engineer was accompanied on his inspection by Mr. James L Fuller, president of the board of water commissioners, Mr. A. E. Tingue, and Mr. C. H. Borst, water commissioners, and Mr. Geo. Van Buren, superintendent. An inspection was made of the watershed, reservoir and filter plant and samples of raw and treated water were collected.

The watershed tributary to the storage reservoir is 1.7 square miles in area. In the immediate vicinity of the reservoir the slopes are comparatively gentle but farther back the area consists of steep side hills. The soil is clay and gravel overlying limestone. Approximately 90 per cent. of the area is cleared land devoted to agriculture, hop growing and dairying and the hill tops are sparsely wooded. There are 10 houses scattered over the watershed and all but one are in the valley within a radius of one mile of the reservoir. The other house is at the very source of a branch of the main brook. The total population is 55, or 32 per square mile.

Most of the privies are located fairly well away from the stream and the reservoir and those nearest are provided with watertight masonry vaults. At the Curtis place about a half mile from the reservoir there is a privy of the ordinary type about 100 feet from the stream. The slope is very gradual but under conditions of heavy rainfall and flood there is some possibility of material from this privy being washed into the stream. At the Manchester place the privy is located about 150 feet from the reservoir. The drainage from this place has to flow indirectly about 500 feet before reaching the reservoir but there is a probability that contaminated material from this privy and from the hog pen and barn yard at the same place will reach the reservoir at times of heavy rainfall and surface run-off. At the Dow place a manure pile was located about 75 feet from the stream at the time of the inspection and the wash from this would eventually reach the brook. In addition to that from these specific sources more or less contamination will reach the stream and reservoir due to the drainage from cultivated fields, barn yards, etc.

Rules and regulations for the sanitary protection of this supply were enacted by this Department in 1890. These rules contain no restrictions on boating, fishing or ice cutting on or in the reservoir or watercourses. On the day of the inspection a fisherman was noticed on the ice of the reservoir. An attempt is made however to keep the watershed as clean as possible and improvements in the sanitary condition of the watershed have been made from time to time. In some places the privies have been relocated, in others they have been provided with masonry vaults. Several years ago a case of typhoid occurred on the watershed but it was removed as soon as discovered.

Some trouble has been experienced due to the growth of algae in the reservoir and in the past two years copper sulphate has been used for destroying those growths and this treatment has met with good success. In 1913, 500 pounds of chemical were used and 400 pounds in 1914.

Some complaints have been made relative to the use of alum in connection with the purification of this supply. Such complaints are frequently made when this method of treatment is first used and are based upon an erroneous conception of the action of the alum. Sulphate of aluminum when applied to a natural water containing alkalinity or carbonate of lime will react with

COLD SPRING

HERMANN M. BIGGS, M.D., *State Commissioner of Health:*

An investigation of the public water supply of Cold Spring was made on November 23, 1915, by Mr. E. S. Chase, assistant engineer in this Department, accompanied and aided by Mr. G. W. Mosher, superintendent of water works for the village.

Cold Spring is an incorporated village with a population of approximately 2,500, located in the northwestern portion of Putnam county on the eastern bank of the Hudson river about 53 miles north of New York city. The village has a public sewer system discharging into the Hudson river.

The water supply is derived from an impounding reservoir located about 2½ miles east of the village on Margaret brook, a tributary to Foundry brook, which in turn flows through the village into the Hudson river. The waterworks were designed by Mr. Francis Henry, civil engineer, and constructed by contract in 1895. Approximately 90 per cent. of the entire population is served by the supply. The daily water consumption, however, is unknown. There are approximately six miles of water mains ranging in size from 4 to 10 inches in diameter. Of the 500 service taps about 300 are metered. The water is distributed by gravity and the pressure in those portions of the village near the river is about 108 pounds per square inch, while in the hill section the pressure is about 42 pounds per square inch. The waterworks are owned by the municipality and are operated under the direction of the board of water commissioners, of which Mr. Vincent Murray is president.

The reservoir is formed by a concrete dam across a narrow ravine. This reservoir is approximately two acres in area and has a maximum depth of 30 or 40 feet. The exact capacity of this reservoir is unknown but may be roughly estimated at about 10,000,000 gallons. This reservoir is blown off twice a year through mud pipes located at the bottom of the dam. The water mains are flushed every spring. The land adjacent to the reservoir is owned by the village.

The watershed area tributary to this reservoir is approximately 2.5 square miles. This area consists in the main of steep wooded hills. There are two artificial ponds located at the head of the stream which afford a reserve supply during the summer.

There are but three farms located upon the watershed and the total population may be estimated at twelve. A highway parallels the stream for practically its entire length. The first farm upon the watershed is located about one mile above the reservoir. At this place a small drainage course flows between the house and barn and within 25 feet of the privy. Opposite this place the brook flows through a marsh of several acres in area which has at times been flooded. At the times when the flooding occurred considerable growths of algae took place, bringing about disagreeable tastes and odors in the water supply furnished the village. An investigation of the condition brought about by this flooding was made by the engineering division in 1910, the report of which will be found on page 521 of the thirty-first annual report of this Department.

The second house on the watershed is about 1½ miles above the reservoir. At this place the brook flows about 75 feet from the privy. The third farm is about two miles above the reservoir and is said to be provided with a cesspool although its location was not known. The barnyard place extends to the stream but otherwise the surroundings at this farm seemed to be in a reasonably satisfactory sanitary condition.

In addition to the contamination from these three farms there is also that occurring from road wash, from cattle pasturing along the stream and from accidental contamination arising from people passing over the watershed.

Rules and regulations for the sanitary protection of this supply were enacted by this Department in 1903. Inspections of the watersheds are made several times a year by the board of water commissioners who also employ a man to make inspections of the watershed about every two weeks.

The results of analyses of numerous samples of this water supply made in the past by the Division of Laboratories and Research will be found in the appended table.

These analyses show a somewhat colored water, at times slightly turbid and very soft. The figures for nitrogen in its various forms are moderately high and are consistent with the conditions existing upon the watershed. The chlorine content is slightly higher than is normal for unpolluted surface waters in this vicinity. The bacterial counts are somewhat high and fecal organisms of the B. coli type are moderately prevalent, indicating active contamination of animal or human origin.

In view of the above facts the following conclusions may be drawn:

1. That at the time of the inspection the public water supply of the village of Cold Spring was of a reasonably satisfactory quality from a physical standpoint although at times in the past it has been subject to disagreeable tastes and odors caused by the development of algae growths in flooded marsh land upon the watershed.

2. That the water supply is subject to contamination by surface wash from highways, pasture lands, barnyards and, possibly, privies.

I would therefore recommend:

1. That the village authorities continue to maintain their careful patrol and inspections of the watershed in order to enforce the provisions of the rules and regulations enacted by this Department.

2. That in view of the ever present possibilities of serious contamination arising from accidental, incidental or wilful pollution of the stream by permanent residents upon the watershed or transient visitors thereto, it would be well for the village to consider the installation of suitable apparatus for the sterilization of the supply with liquid chlorine.

Respectfully submitted,

THEODORE HORTON,
Chief Engineer

ALBANY, N. Y., *December* 8, 1915

REPORT OF WATER ANALYSIS FOR COLD SPRING

Source	Tap, public supply				
Collected on	9/26/10	11/29/10	3/21/11	5/11/11	6/28/11
Color	15	15	8	10	18
Odor, hot	....	....	....	....	....
Odor, cold	....	....	....	....	....
Turbidity	tr.	tr.	5	5	5
Solids, total	72	84	37	44	61
Loss on ignition	33	30	12	12	11
Mineral residue	39	54	25	32	50
Ammonia, free	.022	.004	.012	.020	.022
Ammonia, albuminoid	.142	.062	.068	.104	.068
Nitrites	.002	.002	.002	.002	.001
Nitrates	0.12	0.02	trace	0.04	0.10
Oxygen consumed	2.18	1.60	2.50	1.70	3.10
Chlorine	2.50	2.50	2.50	1.25	1.75
Hardness, total	38.4	45.7	20.8	24.7	31.2
Alkalinity	36	33	19	20	23
Bacteria per c.c.	850	325	850	80	1,300
B. coli type 10 c.c.	+	+	+	—	+
B. coli type 1 c.c.	+	+	—	—	+
B. coli type 1/10 c.c.	—	—	—	—	—

Results are expressed in parts per million. + Present. — Absent.

Abbreviations used to describe odors of water: 0, none; 1, very faint; 2, faint; 3, distinct; 4, decided; 5, strong; 6, very strong; a, aromatic; d, disagreeable; e, earthy; f, fishy; g, grassy; m, musty; v, vegetable.

REPORT OF WATER ANALYSIS FOR COLD SPRING

Source	Tap, public supply				
Collected on	10/18/11	12/5/11	1/6/12	2/20/12	3/26/12
Color	15	10	5	5	tr.
Odor, hot	....	....	....	....	....
Odor, cold	....	....	....	....	....
Turbidity	cl.	cl.	cl.	cl.	tr.
Solids, total	72	51	72	56	64
Loss on ignition	21	10	21	7	12
Mineral residue	51	41	51	49	42
Ammonia, free	.014	.022	.028	.018	.022
Ammonia, albuminoid	.052	.064	.046	.044	.054
Nitrites	.001	.001	tr.	tr.	tr.
Nitrates	tr.	0.05	0.06	0.08	0.04
Oxygen consumed	1.50	1.10	0.10	1.35	0.50
Chlorine	1.62	2.00	2.25	2.25	1.50
Hardness, total	42.9	20.8	23.4	27.3	22.1
Alkalinity	25	20	18	25	12
Bacteria per c.c.	7,800	230	30	50	40
B. coli type 10 c.c.	+	—	+	+	—
B. coli type 1 c.c.	+	—	—	—	—
B. coli type 1/10 c.c.	—	—	—	—	—

Results are expressed in parts per million. + Present. — Absent.
Abbreviations used to describe odors of water: 0, none; 1, very faint; 2, faint; 3, distinct; 4, decided; 5, strong; 6, very strong; a, aromatic; d, disagreeable; e, earthy; f, fishy; g, grassy; m, musty; v, vegetable.

REPORT OF WATER ANALYSIS FOR COLD SPRING

Source	Tap, public supply				
Collected on	4/30/12	8/27/12	10/15/12	12/17/12	1/22/13
Color	10	30	10	10	5
Odor, hot	....	....	....	....	....
Odor, cold	....	....	....	....	....
Turbidity	cl.	10	cl.	cl.	tr.
Solids, total	50	44	78	56	73
Loss on ignition	14	12	15	13	....
Mineral residue	36	32	63	43	....
Ammonia, free	.008	.002	.004	.028	.018
Ammonia, albuminoid	.072	.088	.078	.054	.016
Nitrites	tr.	tr.	.001	.001	tr.
Nitrates	tr.	0.10	0.06	0.02	0.06
Oxygen consumed	1.00	3.00	1.70	1.70	1.60
Chlorine	1.62	1.37	2.37	2.25	2.25
Hardness, total	24.7	29.9	44.3	27.3	24.7
Alkalinity	18	28	35	24	16
Bacteria per c.c	170	3,400	70	60	160
B. coli type 10 c.c.	+	+	—	—	+
B. coli type 1 c.c.	—	+	—	—	—
B. coli type 1/10 c.c.	—	—	—	—	—

Results are expressed in parts per million. + Present. — Absent.
Abbreviations used to describe odors of water: 0, none; 1, very faint; 2, faint; 3, distinct; 4, decided; 5, strong; 6, very strong; a, aromatic; d, disagreeable; e, earthy; f, fishy; g, grassy; m, musty; v, vegetable.

REPORT OF WATER ANALYSIS FOR COLD SPRING

Source	Tap, public supply					
Collected on	2/25/13	4/8/13	5/20/13	7/2/13	3/16/14	10/11/15
Color	15	7	5	15	10	....
Odor, hot	....	....	....	....	1v	....
Odor, cold	....	....	....	....	1v	....
Turbidity	3	2	cl.	tr.	tr.	....
Solids, total	53	44	49	72	48	....
Loss on ignition	....	....	....	....	14	....
Mineral residue	....	....	....	....	34	....
Ammonia, free	.014	.012	.004	.022	.016	....
Ammonia, albuminoid	.054	.070	.036	.058	.036	....
Nitrites	tr.	.001	.001	.001	.002	....
Nitrates	0.10	0.04	0.04	0.12	0.06	....
Oxygen consumed	1.60	2.00	1.30	1.55	2.50	....
Chlorine	2.00	1.62	2.00	1.63	2.00	....
Hardness, total	26.0	20.8	26.0	28.6	28.6	....
Alkalinity	19	14	21	24	22	....
Bacteria per c.c	350	90	80	....	375	650
B. coli type... 10 c.c.	+	+	+	—	—	+
B. coli type... 1 c.c.	—	—	—	—	—	—
B. coli type... 1/10 c.c.	—	—	—	—	—	—

Results are expressed in parts per million. + Present. — Absent.
Abbreviations used to describe odors of water: 0, none; 1, very faint; 2, faint; 3, distinct; 4, decided; 5, strong; 6, very strong; a, aromatic; d, disagreeable; e, earthy; f, fishy; g, grassy; m, musty; v, vegetable.

CORINTH

HERMANN M. BIGGS, M.D., *State Commissioner of Health*:

A reinspection of the public water supply of the village of Corinth was made on May 12, 1915, by Dr. C. S. Prest, sanitary supervisor of District "G." A previous investigation of this supply was made by the engineering division in 1912, a report of which will be found on page 651 of the thirty-third annual report of this Department.

The public water supply of Corinth is derived from two sources; one from reservoirs on Kendall creek and the other from Sturdevant creek. The description of the reservoirs on Kendall creek and of the waterworks system in general remains practically the same as at the time of the previous inspection. However, work is now being carried on in developing the Sturdevant creek supply and a new pumping station has been constructed and a new 6-inch pipe line has been laid from this pumping station to the intake crib about 1,000 feet upstream, where it has been connected with a coke strainer. This supply is designed for use only in times of drought when an insufficient supply can be obtained from Kendall creek. Rules and regulations for the sanitary protection of the public water supply of Corinth derived from Kendall creek were enacted by this Department in 1904. The waterworks are owned and operated by the village.

The watershed of Kendall creek is 1.75 square miles in area, very hilly, wooded, and with a very small proportion of its area devoted to agriculture. The watershed is traversed by a highway along which there are four or five occupied houses. The total population may be estimated at 20, or 11 per square mile.

Sturdevant creek has a watershed area of 10.65 square miles. About one-half of its area consists of the steep side slopes of the range of hills on the west and the remainder of this area is a comparatively level sandy plain at the foot of the hills. This watershed is crossed by several highways and by the Adirondack branch of the D. & H. R. R. There are between 35 and 40 houses on this area, several of which are within the southern part of the village itself but located from 1,000 or 2,000 feet from the stream. The

whole population on this watershed may be estimated at about 200, or approximately 20 per square mile.

At the time of the inspection in 1912 it was noted that there were opportunities for contamination of the Kendall creek supply due to the location of privies within a comparatively short distance of the stream and also from wash from cultivated and manured fields. At the time of the reinspection it was found that nearly all of the privy vaults on this watershed were of concrete construction, but that all were nearly full and needed cleaning. One privy of the ordinary type was located about 50 feet from the brook between the upper and lower reservoirs.

Sturdevant creek is open to indirect contamination from surface wash from a polluted area and also to possible contamination from the discharge from toilets on the passenger trains on the railroad.

The earlier report made the following recommendations:

1. That the violation of the rules and regulations for the sanitary protection of the water supply from Kendall creek be abated by the water commissioners of the village of Corinth in accordance with sections 70, 71 and 73 of the Public Health Law.
2. That should it be the intention of the water commissioners to continue the use of Sturdevant creek as a source of public water supply, they apply to this Department for the amendment of the rules and regulations which will establish sanitary protection for the waters of this stream.
3. That the board of water commissioners cause an investigation to be made of all premises on the watersheds of all streams furnishing water for the public water supply of Corinth for the purpose of ascertaining and abating all possible sources of pollution of such water.
4. That should Sturdevant creek be retained as a source of supply, steps be taken to prevent any intermittent pollution from the toilet rooms of trains entering the watershed at points where the railroad crosses the stream or is constructed along the embankment.
5. That should it be found impracticable or not in accordance with economy to eliminate the pollution of Sturdevant creek caused by those passing over the railroad or any other sources of pollution, the supply from this stream be subjected to some efficient, approved process of filtration or the intake be moved to a point west of and above the railroad tracks.
6. That frequent and thorough inspections be made by the water commissioners of all parts of the watersheds from which any of the public water supply is obtained.

From the report of Dr. Prest it appears that practically none of the above recommendations have been carried out.

At the time of his inspection Dr. Prest collected samples of water from Kendall creek and Sturdevant creek and the results of the analyses of these samples and of others made in the past by the Division of Laboratories and Research will be found in the appended table.

These analyses show a water somewhat colored, at times slightly turbid, and very soft. The bacterial results are somewhat unsatisfactory, being, as a rule, rather high in total numbers of bacteria and with organisms of the B. coli type usually present in 10 c. c., frequently in 1 c. c., and occasionally in 0.1 c. c. inoculations. The analyses of the Sturdevant creek supply would indicate that its bacterial quality, as would be expected, is somewhat inferior to that of the Kendall creek supply.

In view of the above facts the following conclusions may be drawn:

1. That the village authorities have carried out none of the recommendations of this Department.
2. That the water supplies derived from both Kendall and Sturdevant creeks are open to dangerous contamination of human origin from the various permanent sources of pollution located on their respective watersheds.
3. That both the supplies are open to accidental, incidental or wilful

contamination by the resident population on the watersheds or chance visitors thereto.

4. That both supplies, if properly protected and purified, should afford water of reasonably satisfactory quality.

I would therefore recommend:

1. That the village authorities carry out at once the necessary steps for the elimination of the sources of pollution on the Kendall creek watershed in accordance with the rules and regulations enacted by this Department and control as far as possible the contamination reaching Sturdevant creek and, if necessary, apply to this Department for the amendment of the rules and regulations so as to cover the supply derived from the latter source.

2. That the village authorities consider immediately the installation of some method of purification for their water supply by means of a properly designed filtration plant.

3. That pending the installation of such a filtration plant they install and operate apparatus for the sterilization of the water derived from both Kendall and Sturdevant creeks by means of hypochlorite of lime or liquid chlorine.

Respectfully submitted,

THEODORE HORTON,
Chief Engineer

ALBANY, N. Y., *June 1, 1915*

RESULTS OF WATER ANALYSES

Abbreviations used to describe odors of water: 0, none; 1, very faint; 2, faint; 3, distinct; 4, decided; 5, strong; 6, very strong; a, aromatic; d, disagreeable; e, earthy; f, fishy; g, grassy; m, musty; v, vegetable

Municipality	County	Source of sample	Date of collection	PHYSICAL				CHEMICAL (PARTS PER MILLION)											BACTERIOLOGICAL			
						ODOR		SOLIDS			NITROGEN AS—						HARDNESS			B. COLI TYPE† + = PRESENT — = ABSENT		
				Color	Turbidity	Cold	Hot	Total	Loss on ignition	Mineral residue	Free ammonia	Albuminoid ammonia	Nitrites	Nitrates	Oxygen consumed	Chlorine	Total	Alkalinity	Bacteria per c.c.; gelatin 20°; 48 hours	10 c.c.	1 c.c.	1-10 c.c.
Corinth	Saratoga	Tap, public supply	1/31/12	Tr.	Cl.	1 v.	1 v.	31	13	16	.020	.028	.001	0.14	1.80	0.25	18.9	9.0	80	1+2—	0+3—	0+3—
Corinth	Saratoga	Tap, public supply	3/13/12	15	Cl.	1 v.	1 v.	31	7	24	.048	.062	Tr.	0.14	1.20	0.25	20.8	12.0	210	0+3—	0+3—	0+3—
Corinth	Saratoga	Tap, public supply	7/12/12	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	450	3+0—	1+2—	0+3—
Corinth	Saratoga	Upper Kendall reservoir	7/12/12	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	100	3+0—	1+2—	0+3—
Corinth	Saratoga	Lower Kendall reservoir	7/12/12	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	90	3+0—	0+3—	0+3—
Corinth	Saratoga	Intake, Sturdevant creek	7/12/12	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	375	3+0—	0+3—	0+3—
Corinth	Saratoga	Upper Kendall reservoir	5/13/13	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	200	3+0—	1+2—	0+3—
Corinth	Saratoga	Lower Kendall reservoir	5/13/13	5	2	1 a.	1 a.	59	11	48	.008	.044	Tr.	0.10	3.40	0.50	40.3	40.0	110	1+2—	0+3—	0+3—
Corinth	Saratoga	Intake, Sturdevant creek	2/13/13	5	Cl.	1 v.	1 v.	43	10	33	.008	.038	Tr.	0.04	3.20	0.50	26.0	7.0	600	3+0—	3+0—	1+2—
Corinth	Saratoga	Tap, public supply	5/13/13	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	90	1+2—	0+3—	0+3—

CORNING

HERMANN M. BIGGS, M.D., *State Commissioner of Health:*

A reinspection of the public water supply of Corning was made on December 23 and 24, 1914, and completed on January 5, 1915, by Dr. J. A. Conway, sanitary supervisor of District "K." This supply has been under investigation by this Department several times during the past few years and reports in respect to these investigations will be found on pages 696, 523 and 777 of the Twenty-ninth, Thirty-first and Thirty-third Annual Reports of this Department.

The public water supply of Corning is derived from a large circular well located in the valley of the Chemung river just below the city. The water is pumped from this well to two distributing reservoirs and thence distributed by gravity to the city. The water works system in general remains practically the same as described in the earlier reports. About 1910 apparatus for the sterilization of the supply with hypochlorite of lime was installed. Many analyses of this supply have been made in the past by this Department and although most of these analyses have shown the absence of contamination, there have been at times evidences of active contamination. In 1912 a serious outbreak of typhoid fever occurred in the city which upon investigation was attributed to an infection of the water supply at the time of floods in the river and the occurrence of unusual hydrostatic conditions of the ground water. Daily analyses of the water are now being made by Dr. Pinkston of the Steuben County Laboratory and his analyses show that 2 or 3 times in the past two years there has been considerable contamination of the supply indicated by the occurrence of organisms of the B. coli type. In 1913 pollution is said to have been caused by a leaky toilet in the pump house. This condition, however, has been remedied and proper plumbing installed. In the latter part of July or the first of August, 1914, active contamination again occurred. At this time as far as was known there was no unusual hydrostatic condition of the ground water.

At the time of the investigation by this Department in 1912 the following recommendations were made:

1. Apply the hypochlorite more effectually, put in new apparatus at once, provide a more scientific method of procedure for applying the hypochlorite, and provide a separate mixing tank and two solution tanks.
2. Control the overflow at the basin so that no back water can occur again.
3. Collect samples with greater care.
4. Secure the services of an expert at once to study all possible new sources of water supply capable of furnishing an ample supply of pure water, considering the following possibilities:
   (a) wells above the city (b) filter Chemung river (c) nearest gravity supply (d) possibility of filtering the present supply or purifying by other means.

From the report of Dr. Conway it appears that the same method of adding hypochlorite is still in use although there is a mixing tank in which the chemicals are mixed by hand and a settling tank from which the solution enters the main between the well and pump. Occasional complaints are still made that a taste of the hypochlorite can be detected in the water. While the collection of the samples for analyses are probably made with sufficient frequency and attention to details it would appear that the other recommendations have not as yet been acted upon.

At the time of the inspection by Dr. Conway the city was considering the installation of apparatus for the sterilization of the supply with ultra-violet rays. This apparatus has not been installed and it is understood that the city is now considering the installation of apparatus for the application of liquid chlorine. At the time of his inspection Dr. Conway collected samples of water both before and after sterlization and the results of the

analyses of these samples together with others made in the past by the Division of Laboratories and Research will be found in the appended table.

These analyses show a very hard water, colorless and clear. The figures for organic matter in the form of albuminoid ammonia are, in practically all cases, low. On the other hand the figures for nitrogen in the oxidized form of nitrates are high and variable indicating the occurrence of a considerable amount of organic contamination reaching the ground water supply tributary to the well. The chlorine content is very high which is confirmatory evidence of the contamination of the ground water supply in the past. As a rule, the total number of bacteria is low and in the majority of samples organisms of the B. coli type are absent although in one or two samples B. coli have occurred in 10 c. c. samples indicating that at times active contamination reaches the supply. It is at such times that serious contamination of the supply may occur bringing with it possibilities of actual infection as has been evidenced by the epidemics of typhoid in the past. In view of the above facts the following conclusions may be drawn:

1. That the city authorities have attempted in some respects to carry out the past recommendations of this Department although the advice of the Department has not been followed in full.

2. That the water supply although usually free from active contamination is subject at times of unusual hydrostatic ground water conditions to active contamination and even infection.

3. That the method of applying the hypochlorite to the water is somewhat crude and nonuniform.

In view of the above conclusions, I beg to submit the following recommendations:

1. That the city authorities give careful consideration to the past recommendations of this Department as set forth above.

2. That if the present supply is retained the city authorities abandon the present hypochlorite plant, substituting therefor apparatus for the sterilization of the supply with liquid chlorine.

Respectfully submitted,

THEODORE HORTON,
Chief Engineer

ALBANY, N. Y., *September* 1, 1915

RESULTS OF WATER ANALYSES

Abbreviations used to describe odors of water: 0, none; 1, very faint; 2, faint; 3, distinct; 4, decided; 5, strong; 6, very strong; a, aromatic; d, disagreeable; e, earthy; f, fishy; g, grassy; m, musty; v, vegetable

Municipality	County	Source of sample	Date of collection	Physical				Chemical (Parts per Million)											Bacteriological			
						Odor		Solids			Nitrogen as—						Hardness			B. Coli Type + = present — = absent		
				Color	Turbidity	Cold	Hot	Total	Loss on ignition	Mineral residue	Free ammonia	Albuminoid ammonia	Nitrites	Nitrates	Oxygen consumed	Chlorine	Total	Alkalinity	Bacteria per c.c.; gelatin 20°; 48 hours	10 c.c.	1 c.c.	1-10 c.c.
Corning	Steuben	Tap, public supply	5/ 3/10	Tr.	Cl.	....	....	335	84	251	.004	.002	.002	3.20	0.30	20.05	214.5	165.0	5,000	—	—	—
Corning	Steuben	Tap, public supply	7/14/10	Tr.	Cl.	....	....	334	95	239	.008	.030	Tr.	1.00	0.20	18.00	168.6	150.0	150	—	—	—
Corning	Steuben	Tap, public supply	9/16/10	Tr.	Tr.	....	....	356	121	235	.010	.052	.001	3.20	0.20	20.00	165.8	162.0	10	—	—	—
Corning	Steuben	Tap, public supply	11/ 1/10	5	Cl.	....	....	340	62	278	.006	.018	Tr	5.60	0.10	21.00	174.2	147.0	650	—	—	—
Corning	Steuben	Tap, public supply	12/28/10	Tr.	Cl.	....	....	341	108	233	.006	.002	.001	2.40	0.10	19.00	165.8	161.0	1,150	—	—	—
Corning	Steuben	Tap, pump station	1/14/11	Tr.	Tr.	....	....	341	104	237	.020	.056	.002	1.60	0.70	18.25	177.2	170.0	140	—	—	—
Corning	Steuben	Tap, public supply	1/14/11	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	10	—	—	—
Corning	Steuben	Tap, public supply	2/22/11	Tr.	Cl.	....	....	346	67	279	.006	.018	.003	4.00	0.90	19.25	200.0	173.0	40	—	—	—
Corning	Steuben	Tap, public supply	4/18/11	Tr.	Cl.	....	....	329	40	289	.002	.022	Tr.	1.60	0.20	17.50	168.6	163.0	47	—	—	—
Corning	Steuben	Tap, public supply	5/ 2/11	Tr.	Cl.	....	....	114	3	111	.012	.046	.002	0.14	0.50	3.50	98.6	92.0	90	—	—	—
Corning	Steuben	Tap, public supply	6/12/11	Tr.	Cl.	....	....	353	73	283	.004	.008	Tr.	1.20	0.20	18.50	194.2	172.0	500	—	—	—
Corning	Steuben	Tap, public supply	7/19/11	Tr.	Cl.	....	....	371	88	283	.004	.018	.001	2.00	0.30	19.37	168.6	165.0	90	—	—	—
Corning	Steuben	Tap, public supply	9/15/11	Tr.	Cl.	....	....	411	131	280	.004	.018	Tr.	1.60	0.20	19.50	203.0	171.0	40	—	—	—
Corning	Steuben	Tap, public supply	11/ 3/11	5	Tr.	....	....	345	54	291	.006	.008	.001	2.70	0.30	21.50	182.8	174.0	10	—	—	—
Corning	Steuben	Tap, public supply	1/ 9/12	Tr.	Cl.	....	....	363	48	315	.014	.022	.001	3.20	0.10	21.00	191.4	184.0	15	+	—	—
Corning	Steuben	Tap, public supply	2/14/12	Tr.	Cl.	....	....	334	72	262	.024	.030	Tr.	4.00	0.34	21.50	201.5	172.0	10	—	—	—
Corning	Steuben	Tap, public supply	3/21/12	Tr.	Cl.	....	....	323	41	282	.014	.012	Tr.	3.20	1.50	20.00	201.5	165.0	100	+	—	—
Corning	Steuben	Tap, public supply	10/ 7/12	5	Cl.	....	....	322	39	283	.004	.012	.001	1.20	0.70	21.25	208.0	175.0	20	—	—	—
Corning	Steuben	Tap, public supply	11/26/12	Tr.	Cl.	....	....	347	65	282	.008	.010	Tr.	3.40	1.80	21.25	177.6	173.0	10	—	—	—
Corning	Steuben	Tap, public supply	1/ 2/13	Tr.	Cl.	....	....	322	....	....	.012	.016	Tr.	3.40	0.40	21.75	180.0	170.0	70	—	—	—
Corning	Steuben	Tap, public supply	3/12/13	Tr.	Cl.	....	....	340	....	....	.014	.002	Tr.	3.40	0.30	20.75	205.8	164.0	20	—	—	—
Corning	Steuben	Tap, public supply	5/ 5/13	Tr.	Cl.	....	....	353	....	....	.014	.010	Tr.	3.00	0.50	20.70	185.8	163.0	1,500	—	—	—
Corning	Steuben	Tap, public supply	6/10/13	Tr.	Cl.	....	....	321	....	....	.004	.004	Tr.	2.60	0.10	21.50	221.5	166.0	20	—	—	—

CORTLAND

HERMANN M. BIGGS, M.D., *State Commissioner of Health:*

A reinspection of the public water supply of Cortland was made on August 19, 1915, by Dr. Paul E. Brooks, sanitary supervisor of District "D." A previous inspection of this supply was made in 1911 by Prof. H. N. Ogden in connection with his investigation of the sanitary condition of the city as affected by its water supply. The report of Prof. Ogden will be found on page 1070 of the Thirty-second Annual Report of this Department.

The public water supply of Cortland is derived from ground water sources located in the southwestern part of the city. This ground water is developed by a dug well 22 feet in diameter and having a water depth of about 18 feet. This well was dug through about 5 feet of gravel, then through 2 feet of hardpan and then through water-bearing gravel. The bottom of the well is said to be about 3 feet from rock. The well is incased with concrete to its full depth and is covered with a concrete building, the walls of which are continuous with the casing of the well. This building is provided with screened windows and is kept locked. After the construction of the well, in refilling around its perimeter, the surface was filled in for a depth of a foot or more with a layer of closely packed clay in order to prevent surface seepage. At the time of the earlier report this ground water was developed by means of two large open shallow wells. These wells are now used in part, but it is planned to abandon them as soon as a new pumping station is constructed. The new well is about 300 feet from the old reservoir.

From the wells the water is pumped to two standpipes located on a hill to the east of the pumping station. One of these standpipes has been constructed since the time of the early report. The daily water consumption is at present about 1,000,000 gallons.

Since the date of the early report, the city has acquired additional land in the vicinity of its wells, at present having control of about 204 acres. It is expected that additional land in the vicinity will be acquired in the future. Upon the land controlled by the city considerable reforestization has been carried on. A short distance from the wells is Otter Creek and this stream is undoubtedly the ultimate source of a large amount of the Cortland supply, the water from it being strained through the gravel substrata. This stream flows through a farming section and is subject to a moderate amount of contamination by surface wash. The stream is protected from contamination by rules and regulations enacted by this Department in 1912. Some trouble was experienced in the old reservoir due to the growths of algae. With the elimination of this old reservoir and the storage of the water in the new covered well it would seem that the trouble from this cause would be largely eliminated in the future.

At the time of his inspection Dr. Brooks collected samples of water and the results of the analyses of these samples together with others made in the past by the Division of Laboratories and Research will be found in the appended table.

These analyses show a clear, colorless and hard water. The figures for nitrogen and oxygen consumed indicate a moderate amount of decomposing and decomposable organic matter. The oxidized nitrogen is somewhat high as is the chlorine content, indicating the occurrence of organic contamination, well purified, however, by passage through the soil. The total bacterial counts are moderate and with a few exceptions organisms of the B. coli type are absent. The results of the analysis of the sample of March 18, 1912, indicate that at that time surface wash had reached the supply and was bringing about active contamination.

In view of the above facts, the following conclusions may be drawn:

1. That the public water supply of Cortland is of a reasonably satisfactory sanitary and physical quality, although somewhat hard, and in the past, open to growths of algae and to the possibility of contamination by surface wash.

2. That the substitution and use of the new well and the abandonment of the old ones will probably eliminate all danger of surface wash and trouble from algae.

I would, therefore, recommend:

1. That the city authorities continue their careful oversight of their water supply.

2. That the city have regular analyses made from time to time in order that evidence may be had as to the sanitary quality of the supply at different seasons of the year and under varying hydraulic conditions of the ground water.

Respectfully submitted,

THEODORE HORTON,
Chief Engineer

ALBANY, N. Y., *November 20, 1915*

RESULTS OF WATER ANALYSES

Abbreviations used to describe odors of water: 0, none; 1, very faint; 2, faint; 3, distinct; 4, decided; 5, strong; 6, very strong; a, aromatic; d, disagreeable; e, earthy; f, fishy; g, grassy; m, musty; v, vegetable

Municipality	County	Source of sample	Date of collection	Physical				Chemical (Parts per Million)											Bacteriological			
						Odor		Solids			Nitrogen as—						Hardness			B. Coli Type + = present — = absent		
				Color	Turbidity	Cold	Hot	Total	Loss on ignition	Mineral residue	Free ammonia	Albuminoid ammonia	Nitrites	Nitrates	Oxygen consumed	Chlorine	Total	Alkalinity	Bacteria per c.c.; gelatin 20°, 48 hours	10 c.c.	1 c.c	1-10 c.c.
Cortland	Cortland	Tap public supply	2/ 8/12	Tr.	Cl.	....	....	144	16	128	.020	.030	Tr.	1.60	0.20	1.87	114.2	111.0	150	—	—	—
Cortland	Cortland	Tap, public supply	3/18/12	15	10	....	....	131	21	110	.018	.070	Tr.	1.08	1.00	1.25	98.6	83.0	4,600	+	+	—
Cortland	Cortland	Tap, public supply	4/29/12	Tr.	Cl.	....	....	141	20	121	.006	.024	.001	1.20	0.30	1.75	120.0	106.0	475	—	—	—
Cortland	Cortland	Tap, public supply	9/25/12	Tr.	Cl.	....	....	187	22	165	.008	.022	.001	1.20	0.40	2.25	148.6	129.0	50	+	+	—
Cortland	Cortland	Tap, public supply	10/30/12	Tr.	Cl.	....	....	157	18	139	.008	.018	.001	1.00	0.70	2.00	134.2	133.0	30	+	—	—
Cortland	Cortland	Tap, public supply	11/29/12	Tr	Cl.	....	....	166	25	141	.024	.016	Tr.	1.40	1.00	2.00	140.0	130.0	20	—	—	—
Cortland	Cortland	Tap, public supply	12/28/12	Tr.	Cl.	....	....	169	22	147	.020	.058	Tr.	1.20	0.50	2.50	125.8	122.0	15	—	—	—
Cortland	Cortland	Tap, public supply	2/ 5/13	Tr.	Cl.	....	....	148	....	....	.006	.014	Tr.	1.40	0.40	1.75	117.2	110.0	20	—	—	—
Cortland	Cortland	Tap, public supply	3/19/13	Tr.	Tr.	....	....	210	....	....	.034	.010	.001	1.40	0.60	2.50	111.4	110.0	10	—	—	—
Cortland	Cortland	Tap, public supply	5/14/13	Tr.	Cl.	....	....	158	....	....	.004	.010	Tr.	0.90	0.70	2.00	120.0	112.0	110	—	—	—
Cortland	Cortland	Tap, public supply	6/18/13	Tr.	Cl.	....	....	157	....	....	.004	.004	.001	0.80	0.30	2.25	120.0	117.0	20	+	—	—
Cortland	Cortland	Tap, public supply	7/23/13	Tr.	Cl.	....	....	160	....	....	.010	.012	Tr.	1.00	0.70	2.25	131.4	123.0	10	—	—	—
Cortland	Cortland	Tap, public supply	12/ 5/13	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	150	+	—	—
Cortland	Cortland	Tap, public supply	8/18/15	Tr.	Cl.	1 v.	1 v.	193	12	181	.002	.006	Tr.	2.40	0.10	2.00	151.4	130.0	40	—	—	—

DANSVILLE

HERMANN M. BIGGS, M.D., *State Commissioner of Health*:

A reinspection of the public water supply of Dansville was made on February 25, 1915, by Dr. C. V. Patchin, sanitary supervisor of District "L." A previous inspection of this supply was made by the engineering division in 1911, a full report of which will be found on page 728 of the thirty-second annual report of this Department.

The public water supply of this village is derived from two sources, the first, Little Mill creek, which supplies the greater amount, and second, some seven springs, known locally as the Zeigenfus springs, and whatever run-off is collected on the watershed between these springs and the reservoir. The water from both sources is collected in a distribution reservoir about one mile southeast of the village and thence distributed by gravity. The water works system in general remains practically the same as described in detail in the earlier report. The water works are owned and operated by the municipality under the supervision of the board of water and sewer commissioners.

The watershed area of Little Mill creek tributary to the water supply is at present about 7.5 square miles in area. At the time of the earlier inspection its area was approximately 12 square miles but owing to the diversion of a branch of this stream in 1914 an area of about 4½ square miles is now tributary to the Hemlock lake watershed to the east. The present population upon the Little Mill creek watershed may be estimated at approximately 300, or 40 per square mile. Although this area is crossed by numerous highways the majority of the houses are comparatively well distant from the creek and its tributaries, in most cases being from 300 to 1,000 feet distant. At one place, however, there is a privy located about 50 feet from a branch of the stream. In addition to the possibilities for indirect contamination incidental to a comparatively well populated watershed there is also opportunity for direct contamination due to surface run-off from the various highways, from pasture land and manure fields. About three-quarters mile above the intake the stream is crossed by a main line of the D., L. & W. railroad. At this point there is some possibility for intermittent contamination of the stream by persons riding on the train.

The Zeigenfus springs are located partly on private property 1¾ miles east of the village on the side of the mountains. At the time of the earlier inspection there was considerable opportunity for contamination of these springs due to the location of one of the largest in the door yard of a small farmhouse. Since the earlier inspection this farm has been purchased by the village and the sources of pollution have been removed. The barnyard has been abandoned, the watercourse newly tiled and the privy vault removed and disinfected. The privy vault on the Vogel property adjacent has been removed and disinfected, the new vault having tight cement lining. From the Vogel place the stream from the springs flows through pasture land for a distance of perhaps one-quarter of a mile and then passes under the D., L. & W. railroad track. There is possibility here as in the Little Mill creek supply for contamination from passing trains.

At the time of the earlier report it was pointed out that the supply was subject to intermittent pollution by animal or human organic matter, the greater part of which was carried into the reservoir from the watershed of the Zeigenfus springs. It was also pointed out that there was some opportunity for intermittent pollution of the Little Mill creek supply by sewage from railroad trains, organic matter from barnyards and probably a few privies. It was therefore recommended:

1. That the board of water and sewer commissioners prevent any pollution of the watershed by the D., L. & W. R. R. by requiring that the railroad company close the toilets on passenger trains during the time they are passing over this part of the track.

2. That a thorough inspection be made of all parts of the watershed of Little Mill creek and that all direct sources of pollution be eliminated or removed to a safe distance from the streams.

3. That regular and frequent inspections be made by the board of water and sewer commissioners of all the watersheds from which the village water is derived, with the view of preventing any accidental or wilful pollution which otherwise might occur thereon.

4. That the pollution from the Zeigenfus spring source of water supply be corrected by (a) abandoning this source of supply or (b) acquiring the land on this watershed necessary to remove the sources of pollution and permit of the control of the quality of water collected thereon.

5. That should any difficulty be experienced in abating any insanitary conditions which menace the public water supply, the board of water and sewer commissioners apply to the State Department of Health for the enactment of rules and regulations for the sanitary protection of the public water supply of the village of Dansville.

6. That the village should have a thorough investigation made by their engineers of all the conditions surrounding the collection and distribution of the public water supply with reference to the necessity and feasability of installing works for purification, and should it be found necessary or desirable to install such works a further study be made to determine the type of purification which is most economical and best suited to local conditions.

From the report of Dr. Patchin it appears that recommendation 1 was properly attended to about the first part of the year 1912 and a request made of the Lackawanna R. R. by the local authorities for the closing of toilets on passenger trains crossing the watershed and this requirement has been and still is regularly observed. Inspections of the various watersheds have been made at regular and frequent intervals and as already pointed out recommendation 4 has been acted upon. The enactment of rules and regulations has not been requested because it has been considered that the conditions did not warrant this procedure. The water commissioners have procured an estimate as to the cost of installation of a modern filter plant but it has not been deemed advisable to install such a plant at present.

At the time of this inspection Dr. Patchin collected samples from each of the two sources of supply, the results of the analyses of which together with others made in the past by the Division of Laboratories and Research will be found in the appended table.

These analyses show a hard water, usually low in color and at times slightly turbid. The water is comparatively low in decomposable and decomposing organic matter although the chlorine content is above normal for this region. The total bacterial counts are as a rule comparatively high even for a surface supply. Organisms of the B. coli type occur frequently in the 10 c. c. and occasionally in the 1 c. c. inoculations, indicating a certain amount of contamination of human and animal origin.

In view of the above facts the following conclusions may be drawn:

1. That the board of water commissioners of Dansville have taken commendable action toward carrying out recommendations of this Department.

2. That the water supply of Dansville, although comparatively free from sources of direct contamination of human origin, is open to indirect contamination due to the comparatively large resident population upon the watershed.

3. That the supply is also open to accidental, incidental or wilful contamination always present on a populated watershed.

I would therefore recommend:

1. That the board of water commissioners continue their efforts in protecting the supply from contamination along the lines previously recommended.

2. That the village, in order to prevent all danger from contamination from temporary sources, install and operate a suitable apparatus for the sterilization of the supply with liquid chlorine.

Respectfully submitted,

THEODORE HORTON,
Chief Engineer

ALBANY, N. Y., *August* 23, 1915

RESULTS OF WATER ANALYSES

Abbreviations used to describe odors of water: 0, none; 1, very faint; 2, faint; 3, distinct; 4, decided; 5, strong; 6, very strong; a, aromatic; d, disagreeable; e, earthy; f, fishy; g, grassy; m, musty; v, vegetable

Municipality	County	Source of sample	Date of collection	Physical				Chemical (Parts Per Million)											Bacteriological			
						Odor		Solids			Nitrogen as—						Hardness			B. Coli Type + = present — = absent		
				Color	Turbidity	Cold	Hot	Total	Loss on ignition	Mineral residue	Free ammonia	Albuminoid ammonia	Nitrites	Nitrates	Oxygen consumed	Chlorine	Total	Alkalinity	Bacteria per c.c.; gelatin 20°; 48 hours	10 c.c.	1 c.c.	1-10 c.c.
Dansville	Steuben	Tap, public supply	2/15/12	Tr.	Cl.	....	....	166	24	142	.008	.016	Tr.	0.90	0.60	2.50	122.8	119.0	90	+	+	—
Dansville	Steuben	Tap, public supply	3/23/12	10	Tr.	....	....	145	31	114	.006	.038	Tr.	0.72	1.00	2.50	105.8	82.0	1,900	+	+	—
Dansville	Steuben	Tap, public supply	10/ 3/12	10	3	....	....	185	30	155	.002	.012	Tr.	0.60	0.90	2.00	148.3	132.0	750	+	+	—
Dansville	Steuben	Tap, public supply	11/25/12	Tr.	Cl.	....	....	171	18	153	.008	.040	Tr.	0.66	0.90	2.25	134.2	132.0	600	—	—	—
Dansville	Steuben	Tap, public supply	1/ 4/13	2	Cl.	....	....	147	....	....	.012	.044	Tr.	0.80	1.00	2.50	131.4	110.0	250	—	—	—
Dansville	Steuben	Tap, public supply	3/14/13	10	15	....	....	144	....	....	.014	.080	Tr.	0.70	1.90	2.50	77.1	78.0	8,000	+	—	—
Dansville	Steuben	Tap, public supply	5/ 1/13	15	15	....	....	204	....	....	.014	.046	Tr.	0.46	1.90	4.25	137.2	119.0	4,000	—	—	—
Dansville	Steuben	Tap, public supply	6/11/13	15	2	....	....	140	....	....	.004	.022	Tr.	0.70	0.80	2.25	105.8	104.0	2,000	+	+	—
Dansville	Steuben	Little Mill Creek, supply	2/25/15	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	3,900	+	+	—
Dansville	Steuben	Zeigenfus Springs, supply	2/25/15	Tr.	2	1 v.	1 v.	195	35	160	.006	Tr.	.002	0.40	2.90	4.75	92.9	50.0	40	—	—	—

DAVENPORT

HERMANN M. BIGGS, M.D., *State Commissioner of Health*:

An investigation of the public water supply of the village of Davenport was made on August 2, 1915, by Mr. Morton F. Sanborn, assistant engineer. The inspector was assisted at the time of the inspection by the president of the water company, Mr. William McDonald, the secretary, E. G. Sherman, and the health officer of the town of Davenport, Dr. T. L. Craig.

Davenport is an unincorporated village located in the town of Davenport in the valley of Charlotte creek. It is about twelve miles east of the city of Oneonta and five miles from Davenport Center, the nearest railroad station on the Ulster and Delaware R. R. The population of the village was estimated at the time of the inspection at about 200.

The public water supply is furnished by the Davenport Water Company and is used for household purposes and fire protection. The water works were designed by Mr. F. W. Roundy, C. E., and constructed by the water company in 1894 under the direction of Mr. Roundy.

The water is obtained from four springs located about one-quarter of a mile south of the village on the side of a hill. From these springs the water flows to a concrete reservoir and thence to the distributing system by gravity. About 160 persons, or 80 per cent. of the total population, are served by this water supply. Of the 45 houses in the water district 32 are connected with the distribution system. There are about 1¼ miles of water mains ranging from 4 to 6 inches in diameter. Fire protection is provided by hydrants placed in various parts of the village. The average pressure in the village is about 65 pounds per square inch. No definite figures could be obtained as to the water consumption but it was estimated by the secretary that the total consumption would be about 9,600 gallons per day, corresponding to a per capita consumption of about 60 gallons.

There is no sewer system or method of sewage disposal except local cesspools, septic tanks and privies.

The springs are about 100 feet apart and the reservoir is immediately below the northerly spring. Each spring is surrounded by a stone wall with concrete bottom and covered with a wooden roof. A 4-inch pipe leads from the springs to the reservoir. The effluent pipe from each spring rests practically on the concrete bottom of the spring. Two or three hundred feet above the springs is a good sized brook which drains the land above. The water of this brook disappears in the rock and undoubtedly a large part of the brook water reaches the springs. Above the springs are outcrops of sandstone and shale while below the springs the soil is more or less impervious and consists largely of sand and gravel. At the time of the inspection the ground near the springs was quite wet, due to recent rains.

The reservoir is of concrete, 20 feet by 40 feet in plan and 10 feet deep covered with a wooden roof, and with a capacity of about 60,000 gallons representing about 6 days' consumption of water. The reservoir is cleaned and the water mains flushed about twice a year.

The watershed above the springs amounts to .15 square mile although the possible area contributing to the springs at the elevation of the springs may be estimated as one square mile. There are no houses or buildings of any character on the watershed. The field above and around the springs is used for pasture and undoubtedly considerable pollution of the water is caused by the cattle.

At the time of the inspection a sample of water was collected from a tap in the village and the results of the analyses are shown in the appended table.

From these analyses it is evident that the water is moderately soft, has a trace only of color and turbidity and a slight vegetable odor. The nitrogenous organic matter present is not high although carbonaceous organic matter is present in moderate amounts as shown by the figures for oxygen

consumed. The total numbers of bacteria are high for a ground water and the occurrence of B. coli in quantities as small as 1 c. c. indicates contamination of animal or human origin. In this case these results are probably due to the pasturing of cattle upon the watershed of the brook above the spring.

As a result of this investigation and of the analyses the following conclusions may be drawn:

1. That the public water supply of Davenport, if properly protected from permanent sources of animal pollution and from accidental contamination of human origin, should be of a reasonably satisfactory quality.
2. That the supply is open to animal pollution from the cattle pastured upon the watershed of the small brook which forms the source of a portion of the supply tributary to the springs.
3. That the supply is open to accidental or wilful contamination from human sources by chance visitors to the vicinity of the springs.

In view of the above conclusions I would recommend that the water company take such steps as are necessary to safeguard the water from pollution and this may be accomplished in the following manner:

1. That the area surrounding the springs be fenced off to keep cattle and people away from the immediate vicinity of the springs.
2. That the watershed of the brook above the springs be abandoned for pasturing cattle, especially that portion along the banks of the brook.

Respectfully submitted,
THEODORE HORTON,
Chief Engineer

ALBANY, N. Y., *September* 16, 1915

REPORT OF WATER ANALYSIS FOR DAVENPORT

Source		Tap in village
Collected on		8/2/15
Color		Trace
Odor, hot		2v
Odor, cold		2v
Turbidity		Trace
Solids, total		48
Loss on ignition		10
Mineral residue		38
Ammonia, free		.010
Ammonia, albuminoid		.040
Nitrites		.001
Nitrates		0.10
Oxygen consumed		1.50
Chlorine		0.50
Hardness, total		24.70
Alkalinity		22.00
Bacteria per c.c		600
B. coli type	10 c.c.	3+0—
	1 c.c.	1+2—
	1/10 c.c.	1+2—

Results are expressed in parts per million. + Present. — Absent.

Abbreviations used to describe odors of water: 0, none; 1, very faint; 2, faint; 3, distinct; 4, decided; 5, strong; 6, very strong; a, aromatic; d, disagreeable; e, earthy; f, fishy; g, grassy; m, musty; v, vegetable.

DEANSBORO

HERMANN M. BIGGS, M.D., *State Commissioner of Health:*

A reinspection of the public water supply of Deansboro was made on November 17, 1915, by Dr. J. E. Clark, sanitary supervisor of District "E." A previous inspection of this supply was made in 1909 by the Engineering Division, a full report of which will be found on page 296, Vol. II of the Thirtieth Annual Report of this Department.

The water supply of Deansboro is derived from a collecting well on a small spring fed stream located about ¾ of a mile due west of the village center. There are two large springs feeding the stream, known as the Munsell Spring and the Bishop Spring. The description of these springs and of the water works system in general remain practically the same as given in detail in the earlier report.

The watershed tributary to the reservoir is approximately ½ square mile in area. This area is used chiefly for pasture land and cattle have access to the stream. There are two families living upon this watershed although the houses are fairly distant from the stream and it is therefore improbable that there is any pollution of human origin.

A previous report pointed out the opportunity for pollution of the springs and streams by cattle and recommended that steps be taken to protect the water supply by enclosing the main springs on the Bishop and Munsell properties with masonry walls and by extending the pipe line from the village directly to the springs. It was also recommended that, in case the water company had any difficulty with the owners of the land upon which the above springs were located in making arrangements to bring about the above improvements, they consider the matter of applying to this Department for the enactment of Rules and Regulations for the protection of their supply.

From the report of Dr. Clark and from information filed in this Department it appears that the Water Company has carried out the recommendations above noted. Rules and Regulations for the sanitary protection of this supply was enacted on March 3, 1911. Following the enactment of these rules the water company instituted proceedings against the owners of the Munsell spring and as a result of this action secured an injunction prohibiting the contamination of the water supply. Furthermore, a certain amount of land surrounding the springs was purchased in order to more fully protect the supply from contamination. Inspections of the watershed are made at least once a month.

At the time of his inspection Dr. Clark collected samples of water and the results of the analyses of these samples together with others made in the past by the Division of Laboratories and Research will be found in the appended table.

These analyses show a water slightly colored, occasionally turbid and very hard. The figures for nitrogen in its various forms are somewhat high and variable, indicating the presence of moderate amounts of decomposing and decomposable organic matter. The chlorine content is above the normal found in unpolluted waters of this region. The total bacterial counts are high and frequently excessive, while the frequent presence of fecal organisms of the B. coli type in samples as small as 1 c. c. indicates the occurrence of active contamination of animal or human origin. In view of the conditions existing upon the watershed, it seems probable that this contamination is caused by the cattle pastured near the streams and by surface wash from farm lands.

In view of the above facts the following conclusions may be drawn:

1. That the Deansboro Water Company has carried out the previous recommendations of this Department and has displayed commendable activity in enforcing the provisions of the rules and regulations enacted by this Department.

2. That, however, the water supply is subject to contamination from surface wash and from cattle pastured upon the watershed.

I would, therefore, recommend:

1. That the Deansboro Water Company make a careful study of the conditions surrounding the springs, streams and reservoirs in order to determine by what method it may be practicable to still further improve the physical and sanitary quality of the supply. Steps should be taken to exclude surface wash from the springs and to prevent contamination of the supply by cattle.

Respectfully submitted,

THEODORE HORTON,

Chief Engineer

ALBANY, N. Y., *December* 21, 1915

RESULTS OF WATER ANALYSES

Abbreviations used to describe odors of water: 0, none; 1, very faint; 2, faint; 3, distinct; 4, decided; 5, strong; 6, very strong; a, aromatic; d, disagreeable; e, earthy; f, fishy; g, grassy; m, musty; v, vegetable

Municipality	County	Source of sample	Date of collection	Physical				Chemical (Parts Per Million)											Bacteriological			
						Odor		Solids			Nitrogen as—						Hardness		Bacteria per c.c.; gelatin 20°; 48 hours	B. Coli Type + = present — = absent		
				Color	Turbidity	Cold	Hot	Total	Loss on ignition	Mineral residue	Free ammonia	Albuminoid ammonia	Nitrites	Nitrates	Oxygen consumed	Chlorine	Total	Alkalinity		10 c.c.	1 c.c.	1-10 c.c.
Deansboro	Oneida	Tap, public supply	1/24/10	5	10	....	....	223	....	180	.030	.048	.005	1.20	1.20	2.37	174	139	1,600	+	—	—
Deansboro	Oneida	Tap, public supply	5/ 5/10	1	5	....	....	312	....	244	.014	.038	.002	0.90	0.90	1.50	200	195	1,600	+	+	+
Deansboro	Oneida	Tap, public supply	11/ 1/10	10	5	....	....	285	....	234	.024	.048	.003	2.20	2.20	1.75	229	228	500	+	+	—
Deansboro	Oneida	Tap, public supply	12/21/10	Tr.	Tr.	....	....	266	....	245	.012	.062	.003	0.70	0.70	1.25	236	225	2,300	+	+	—
Deansboro	Oneida	Tap, public supply	2/17/11	Tr.	Cl.	....	....	266	....	229	.020	.032	.003	3.20	1.60	2.00	222	215	1,400	+	+	—
Deansboro	Oneida	Tap, public supply	4/24/11	5	5	....	....	249	....	197	.018	.054	.003	2.40	0.90	3.00	194	192	3,200	+	—	—
Deansboro	Oneida	Tap, public supply	6/ 8/11	10	15	....	....	267	....	223	.006	.038	.002	1.00	1.30	2.25	222	220	370	+	+	—
Deansboro	Oneida	Tap, public supply	9/ 9/11	5	50	....	....	311	....	239	.006	.210	.001	0.80	2.40	1.75	236	226	28,000	+	+	+
Deansboro	Oneida	Tap, public supply	11/18/11	Tr.	Cl.	....	....	290	....	277	.030	.038	.001	0.80	0.75	2.12	222	200	110	+	—	—
Deansboro	Oneida	Tap, public supply	1/ 3/12	5	Tr.	....	....	268	....	230	.018	.040	Tr.	2.00	0.50	2.75	229	221	700	+	+	—
Deansboro	Oneida	Tap, public supply	2/16/12	5	Tr.	....	....	258	....	235	.004	.020	.001	2.20	0.70	2.00	229	226	160	+	—	—
Deansboro	Oneida	Tap, public supply	3/27/12	Tr.	Tr.	....	....	256	....	228	.010	.028	Tr.	2.16	0.10	2.50	229	205	1,600	+	—	—
Deansboro	Oneida	Tap, public supply	5/ 3/12	5	5	....	....	261	....	222	.002	.054	.001	1.80	0.50	2.00	215	212	350	+	+	—
Deansboro	Oneida	Tap, public supply	9/14/12	15	10	....	....	243	....	223	.004	.084	.001	0.68	3.10	1.50	215	198	350	+	+	—
Deansboro	Oneida	Tap, public supply	10/22/12	5	3	....	....	260	....	234	.004	.044	.001	1.00	1.00	2.00	229	217	6,500	+	—	—
Deansboro	Oneida	Tap, public supply	12/ 4/12	5	5	....	....	260	....	224	.002	.064	Tr.	1.60	1.10	2.00	222	219	2,500	+	+	—
Deansboro	Oneida	Tap, public supply	1/15/13	5	Cl.	....	....	269	....	....	.016	.026	Tr.	2.60	0.80	2.75	222	216	550	+	—	—
Deansboro	Oneida	Tap, public supply	2/12/13	5	Tr.	....	....	262	....	....	.008	.032	Tr.	1.90	0.80	2.50	229	217	350	—	—	—
Deansboro	Oneida	Tap, public supply	3/26/13	10	15	....	....	268	....	....	.016	.082	.001	1.50	1.30	2.75	208	193	3,000	+	—	—
Deansboro	Oneida	Tap, public supply	5/ 7/13	5	5	....	....	247	....	....	.002	.032	.001	1.80	0.20	2.50	215	209	275	+	+	+
Deansboro	Oneida	Tap, public supply	6/25/13	5	5	....	....	264	....	....	.008	.040	.002	1.00	1.50	2.25	195	195	......	+	+	—
Deansboro	Oneida	Tap, public supply	5/ 5/14	Tr.	2	1 v.	1 v.	270	42	228	.012	.038	.001	2.00	1.00	3.25	215	207	1,000	+	—	—
Deansboro	Oneida	Tap, public supply	11/17/15	Tr.	....	....	....	....	....	....	....	....	....	....	....	....	....	....	240	3+0—	1+2—	1+2—
Deansboro	Oneida	Collecting well	11/17/15	Tr.	1	1 v.	1 v.	281	41	240	.008	.040	.001	1.60	1.90	2.50	236	231	750	3+0—	0+3—	0+3—

DELEVAN

HERMANN M. BIGGS, M.D., *State Commissioner of Health:*

A reinspection of the public water supply of Delevan was made on May 18, 1915, by Dr. J. J. Mahoney, sanitary supervisor, of District "M." A previous inspection of this supply was made in 1912 by the engineering division, a full report of which will be found on page 655 of the Thirty-third Annual Report of this Department.

The public water supply of Delevan is derived from a number of springs issuing at the foot of a steep slope in the valley of a small stream located about one mile west of the village. In addition to the regular supply from these springs an emergency supply may be derived from the stream, this supply being developed by a small dam across the stream a short distance above the springs. The manner of development of the springs and the water supply system in general remain practically the same as described in detail in the earlier report. The water works are owned and operated by the Delevan Water Company.

The watershed of the stream and springs is absolutely uninhabited and consequently there are no permanent sources of human contamination. A portion of the watershed of the stream is used for pasturage and consequently there is opportunity for contamination of animal origin. The manner of development of the springs is such that there is possibility of their contamination by surface wash at times of rainfall. It is, however, probable that a certain amount of danger of human contamination lies in the possibility of accidental, incidental or wilful contamination by chance visitors upon the watershed of the stream or in the vicinity of the springs.

At the time of the previous inspection it was pointed out that while the supplies were apparently free from human contamination both supplies were at times affected by surface wash from pasture lands. It was also pointed out that the storage was somewhat inadequate for fire or other emergency. It was therefore, recommended:

1. That the springs constituting the regular water supply of the village be protected from any surface wash from the pasture land, during heavy rains or from the melting of snow by the construction on the hillside above the springs of a trench or trenches of sufficient depth and width as to effectively intercept surface waters and drain them to a point below the intake.

2. That the water from the emergency creek supply be made immediately available for fire purposes at all times by connecting the pipe line from the creek dam directly with the equalizing reservoir below, and providing it with a float valve in the equalizing reservoir in such a manner that the creek water would be shut off except in case of fire or at such times as there is a large draft on the system from the village.

From the report of Dr. Mahoney it appears that neither of these recommendations has been carried out by the water company.

At the time of his inspection Dr. Mahoney collected samples of water from both sources of supply and the results of the analyses of these samples together with others made in the past by the Division of Laboratories and Research will be found in the appended table.

These analyses show a water usually free from color and turbidity and very hard. The figures for nitrogen in its various forms indicate the comparative freedom of the supply from decomposing or decomposable organic matter although occasionally these figures are somewhat high due probably to the influence of surface wash. The bacterial counts are in most cases moderate and the organisms of the B. coli type are present in 10 c. c. samples only. From a consideration of the character of the watershed tributary to the supply it seems evident that the occasional presence of B. coli is due to contamination of animal origin.

view of the above facts the following conclusions may be drawn:

1. That the Delevan Water Company has not carried out any of the recommendations of this Department.

2. That ile the water supply of this village is of a reasonably satisfactory sa ary quality the need still exists for the more careful pro- -- springs from surface wash and for the development of the pply for more adequate fire protection.

ore, recommend:

Delevan Water Company carry out at once the recommenda- previous report as given in detail above.

Respectfully submitted,

THEODORE HORTON,
Chief Engineer

Y., *October* 26, 1915

RESULTS OF WATER ANALYSES

Abbreviations used to describe odors of water: 0, none; 1, very faint; 2, faint; 3, distinct; 4, decided; 5, strong; 6, very strong; a, aromatic; d, disagreeable; e, earthy; f, fishy; g, grassy; m, musty; v, vegetable

Municipality	County	Source of sample	Date of collection	Physical				Chemical (Parts per Million)												Bacteriological			
						Odor		Solids			Nitrogen as—						Hardness			B. Coli Type + = present — = absent			
				Color	Turbidity	Cold	Hot	Total	Loss on ignition	Mineral residue	Free ammonia	Albuminoid ammonia	Nitrites	Nitrates	Oxygen consumed	Chlorine	Total	Alkalinity	Bacteria per c.c.; gelatin 20°; 48 hours	10 c.c.	1 c.c.	1-10 c.c.
Delevan	Cattaraugus	Tap, public supply	12/19/12	Tr.	Cl.	....	..	142	16	126	.014	.016	Tr.	0.80	0.60	1.25	117.2	116.0	400	—	—	—
Delevan	Cattaraugus	Tap, public supply	1/29/13	Tr.	Cl.	....	..	161	..	....	.010	.020	Tr.	0.44	0.60	0.75	117.2	117.0	10	—	—	—
Delevan	Cattaraugus	Tap, public supply	2/25/13	10	2	....	..	144	....	....	.034	.032	Tr.	0.36	1.20	0.75	120.0	117.0	70	+	—	...
Delevan	Cattaraugus	Tap, public supply	5/18/15	Tr.	Cl.	1 v.	v.	200	30	170	.004	Tr.	Tr.	0.60	0.40	1.25	122.8	122.0	10	0+3—	0+3—	0+3—
Delevan	Cattaraugus	Tap, auxiliary supply	5/18/15	10	Tr.	1 v.	v.	142	32	110	.008	.006	Tr.	1.00	1.40	2.00	105.8	102.0	350	2+1—	0+3—	0+3—

DELHI

HERMANN M. BIGGS, M.D., *State Commissioner of Health*:

A reinspection of the public water supply of Delhi was made in June, 1915, by Dr. C. C. Duryee, sanitary supervisor of District "C." A previous investigation of this supply was made in 1908 by the Engineering Division, a full report of which will be found on page 285 of the Twenty-ninth Annual Report of this Department.

The water supply of Delhi is derived from a reservoir on Steele brook, about one mile west of the village. The water supply system remains practically the same as described in detail in the earlier report. The water works are owned and operated by the village under the direction of the board of water commissioners.

Steele brook above the reservoir has a watershed area of 5.7 square miles. The resident population upon this area may be estimated at 120, or 21 per square mile. The drainage area consists principally of fairly steep side slopes devoted to agriculture and grazing. The area is crossed by several highways along which the various houses are located. In most cases these houses are fairly well distant from the stream or its tributaries. The principal sources of contamination are from road wash and surface run-off from manured fields and pasture lands. At the time of the earlier report it was pointed out that there were six possible sources of pollution of the supply, these sources being privies or cesspools located within a short distance of the stream or its tributaries. At the time of the recent inspection it was found that several of these sources had been eliminated. The privy at the Kemp school house, however, was found in bad condition and the location of this privy should be changed and a concrete vault constructed. It was also found that the privies at the Young place and at the Valentino place should be relocated or provided with watertight vaults. A pig-pen on the Hamilton farm was also a possible source of contamination to the supply.

A new creamery has been erected near the stream tributary to the brook but on the day of reinspection the stream was found to be unaffected by any creamery wastes. The creamery pumps the wastes into a large vat located on the hill in the rear of the building about 1,000 feet distant. From this vat the wastes are emptied into sprinkling wagons and distributed over the ground for fertilizer. This creamery has been inspected in the past by this Department and at the time was found to cause little if any contamination of the stream. At the farm back of the creamery, a tributary of Steele brook flows directly through the barnyard and at this point there is considerable opportunity for contamination of animal origin.

The earlier report recommended that the village authorities:

1. Make a thorough inspection of the watershed of Steele brook and its branches.
2. Take measures to remove all existing sources of pollution on the watershed and to guard against their recurrence in the future.
3. In case they experience any difficulties in removing these sources of pollution or otherwise find it impracticable to thus clean up their watershed and protect their supply, to consider the question of applying to this Department for the enactment of rules and regulations for the protection of their water supply.

From the report of Dr. Duryee it appears that the village authorities have taken commendable action toward carrying out the recommendations of this Department. Rules and regulations for the sanitary protection of the supply were enacted by this Department in 1911.

The results of analyses of samples of water of this supply made in the past by the Division of Laboratories and Research will be found in the appended table.

These analyses show a very soft water, somewhat colored and turbid. The figures for decomposing and decomposable organic matter are somewhat high

and the chlorine content is above normal for this vicinity. The total number of bacteria are usually very high and organisms of the B. coli type are almost always present in 10 c. c. and frequently present in 1 c. c., thereby indicating the occurrence of considerable contamination of animal or human origin.

From the conditions on the watershed it would appear that this contamination is largely due to surface wash from barnyards, manured fields, highways and in a few instances, possibly, from privies.

In view of the above facts the following conclusions may be drawn:

1. That the village authorities have apparently taken steps to carry out the recommendations of this Department.
2. That the water supply of Delhi, however, is open at times of heavy rainfall to serious contamination of animal and to some extent of human origin.

I would, therefore, recommend:

1. That the village authorities abate the sources of contamination noted in detail in the report:
2. That, in order to avoid the danger arising from intermittent contamination of an accidental, incidental or wilful nature, practically unavoidable on a comparatively well-populated watershed, the village install and operate suitable apparatus for sterilization of the water supply with liquid chlorine.
3. That in case the above methods are found insufficient to secure a water supply of satisfactory physical and sanitary quality, the village construct a modern filtration plant for further purification of the supply.

Respectfully submitted,

THEODORE HORTON,

Chief Engineer

ALBANY, N. Y., *November* 12, 1915

RESULTS OF WATER ANALYSES

Abbreviations used to describe odors of water: 0, none; 1, very faint; 2, faint; 3, distinct; 4, decided; 5, strong; 6, very strong; a, aromatic d, disagreeable; e, earthy; f, fishy; g, grassy; m, musty; v, vegetable

Municipality	County	Source of sample	Date of collection	Physical: Color	Physical: Turbidity	Physical: Odor: Cold	Physical: Odor: Hot	Chemical (parts per million): Solids: Total	Solids: Loss on ignition	Solids: Mineral residue	Nitrogen as—: Free ammonia	Nitrogen as—: Albuminoid ammonia	Nitrogen as—: Nitrites	Nitrogen as—: Nitrates	Oxygen consumed	Chlorine	Hardness: Total	Hardness: Alkalinity	Bacteriological: Bacteria per c.c.; gelatin 20°, 48 hours	B. Coli Type (+ = present, — = absent): 10 c.c.	1 c.c.	1-10 c.c.
Delhi	Delaware	Tap, public supply	6/16/11	5	5	....	....	33	11	22	.018	.090	.002	0.30	2.40	0.50	15.6	8.0	300	+	—	—
Delhi	Delaware	Tap, public supply	10/30/11	10	5	....	....	38	13	25	.006	.142	.001	0.40	2.60	1.25	14.3	8.0	700	+	+	—
Delhi	Delaware	Tap, public supply	1/29/12	5	15	....	....	41	4	37	.018	.044	Tr.	0.80	0.80	1.25	20.8	11.0	1,500	+	—	—
Delhi	Delaware	Tap, public supply	3/10/12	10	10	....	....	47	22	25	.018	.092	.001	1.02	2.20	1.75	24.7	10.0	2,800	+	+	—
Delhi	Delaware	Tap, public supply	4/12/12	10	Tr.	....	....	23	6	17	.014	.052	.001	0.50	1.30	0.75	16.9	5.0	200	+	—	—
Delhi	Delaware	Tap, public supply	10/11/12	10	Cl.	....	....	48	17	31	.004	.070	Tr.	0.12	1.80	1.25	26.0	20.0	900	+	+	—
Delhi	Delaware	Tap, public supply	11/15/12	5	5	....	....	35	13	22	.014	.082	Tr.	0.64	0.80	1.00	19.5	8.0	210	+	—	—
Delhi	Delaware	Tap, public supply	1/ 3/13	10	15	....	....	30	....	....	.010	.106	.001	1.00	3.10	1.25	16.9	8.0	5,300	+	+	—
Delhi	Delaware	Tap, public supply	2/ 7/13	Tr.	3	....	....	29	....	....	.012	.053	Tr.	0.70	1.60	1.25	15.0	7.0	500	+	+	—
Delhi	Delaware	Tap, public supply	3/20/13	5	5	....	....	37	....	....	.018	.066	.001	0.70	1.60	0.50	11.1	7.0	400	+	—	—
Delhi	Delaware	Tap, public supply	4/24/13	Tr.	5	....	....	40	....	....	.016	.060	Tr.	0.34	1.10	0.50	9.5	7.0	850	+	—	—
Delhi	Delaware	Tap, public supply	6/ 5/13	15	4	....	....	34	....	....	.010	.066	Tr.	0.16	1.40	0.50	12.7	11.0	9,800	+	+	—
Delhi	Delaware	Tap, public supply	7/17/13	17	7	....	....	48	....	....	.016	.116	.002	0.34	2.90	1.50	16.9	15.0	17,500	+	+	—
Delhi	Delaware	Tap, public supply	4/ 1/15	15	25	1 v.	1 v.	44	13	31	.046	.134	.001	0.80	3.70	1.00	9.5	3.0	8,600	+	+	—

DEPOSIT

HERMANN M. BIGGS, M.D., *State Commissioner of Health*:

A reinspection of the public water supply of Deposit was made on August 12, 1915, by Dr. Paul B. Brooks, sanitary supervisor of District "D." A previous inspection of this supply was made in 1909 by the Engineering Division, the report of which will be found on page 299, vol. 2, of the Thirtieth Annual Report of this Department.

The public water supply of this village is derived from Butler brook, about two miles north of the village. Since the time of the earlier report there has been considerable change in the water works system. The water supply is now subjected to filtration through a slow sand filter located a short distance above the old reservoir on Butler brook. A new reservoir has also been constructed at the filter. The reservoir described in the previous report, as the new or storage reservoir, is now used to supplement the supply impounded in the reservoir recently constructed.

The recently constructed reservoir is primarily supplied with water taken through a pipe which derives its supply from the creek about one-half mile above the reservoir and above the only house on the watershed. Another pipe leads from the filters to the storage reservoir located northeast of the village.

The filter is surrounded by a concrete wall approximately 120 x 200 feet in plan. This filter is subdivided into two parts so arranged that one or the other may be out of service for cleaning. The filtering material consists of 24 inches of graded stone and 12 inches of sand. An additional 24-inch layer of sand is to be added at some later date. After passing through the filter, the water is collected in a circular concrete well about 50 feet in diameter and perhaps 8 or 10 feet deep. From this well the water flows into the main leading to the village.

The reservoir located below the filter is used only for emergency and at times of fire. The water entering this reservoir is open to some contamination from surface wash and from various houses located on the watershed tributary to it.

At the time of the earlier report it was pointed out that there were numerous opportunities for contamination of the stream due to the location of privies, stables, and manure piles adjacent to it. It was therefore recommended:

1. A thorough inspection of the two farms on the watershed of the new reservoir should be made and all sources of pollution removed.
2. A careful oversight over these houses should be maintained. Regular inspections should be made, and if these reveal any cases of typhoid fever, precautionary measures should be taken to prevent any further infection or spread of that disease.
3. Inasmuch as it is necessary to supplement the new sources of supply with the old, a complete inspection of the entire watershed of Butler brook should be made and measures taken to move all privies back from the watercourse and to remove all existing sources of pollution and to prevent their recurrence.
4. In case any difficulty is experienced by the company in removing sources of pollution or it is otherwise found impracticable to protect their supply, that the company consider the question of application to this Department for the enactment of rules and regulations in accordance with sections 70 and 71 of the Public Health Law.

From this report of Dr. Brooks it appears that the water company has carried out commendable steps toward the protection of the water supply by the construction of a slow sand filter.

At the time of his inspection Dr. Brooks collected samples of the water, the results of the analyses of which together with others made in the past by the Division of Laboratories and Research will be found in the appended table.

These analyses show a somewhat unsatisfactory sanitary quality of the raw water supply, the total bacterial counts being high and fecal organisms of the B. coli type frequently present in 1 c. c. and occasionally in 1/10 c. c. From a physical standpoint the water is apparently satisfactory, except for its occasional turbidity, being moderately low in color and very soft. The analyses of the filtered water were too few in number to indicate accurately the efficiency of the filter plant at all times. The results of the analyses of the samples collected at the time of the reinspection were not particularly satisfactory, the total bacterial counts being high and fecal organisms moderately prevalent.

In view of the above facts the following conclusions may be drawn:

1. That the Deposit Water Works Company has acted in general accordance with the recommendations made by this Department for the improvement of their water supply.

2. That the filtration plant from the information available appears to be constructed in accordance with fairly good engineering practice. The addition of the extra 2 feet of filter sand and the covering of the beds as proposed, is a further step in the right direction.

3. That the supply tributary to the old reservoir and now kept in reserve for emergency use is still open to the same sources of contamination as described in detail in the previous report.

I would therefore recommend:

1. That the water company have regular analyses made from time to time in order to determine the efficiency of their filtration plant.

2. That the water company, if it has not already done so, add the extra 2 feet of filter sand and cover the filters with a proper roof for protection against the weather.

3. That the reserve storage reservoir be used in time of emergency only, and in case all sources of contamination are not removed from its watershed the supply when used be subjected to sterilization with liquid chlorine or pumped to the filter for purification.

Respectfully submitted,

THEODORE HORTON,
Chief Engineer

ALBANY, N. Y., *November* 23, 1915

RESULTS OF WATER ANALYSES

Abbreviations used to describe odors of water: 0, none; 1, very faint; 2, faint; 3, distinct; 4, decided; 5, strong; 6, very strong; a, aromatic; d, disagreeable; e, earthy; f, fishy; g, grassy; m, musty; v, vegetable

Municipality	County	Source of sample	Date of collection	Physical – Color	Physical – Turbidity	Physical – Odor – Cold	Physical – Odor – Hot	Chemical (Parts per Million) – Solids – Total	Solids – Loss on ignition	Solids – Mineral residue	Nitrogen as— Free ammonia	Nitrogen as— Albuminoid ammonia	Nitrogen as— Nitrites	Nitrogen as— Nitrates	Oxygen consumed	Chlorine	Hardness – Total	Hardness – Alkalinity	Bacteriological – Bacteria per c.c.; gelatin 20°; 48 hours	B. Coli Type (+ = present, — = absent) 10 c.c.	1 c.c.	1-10 c.c.
Deposit	Broome	Tap, public supply	5/20/10	5	5	....	....	26	5	21	.010	.044	.001	0.06	1.60	0.62	10.2	10.0	85	+	—	—
Deposit	Broome	Tap, public supply	1/17/11	10	10	....	....	45	13	32	.022	.092	.003	0.60	1.10	1.25	11.1	9.0	1,600	+	+	+
Deposit	Broome	Tap, public supply	4/ 1/11	5	15	....	....	40	20	20	.030	.052	.002	0.60	1.60	1.50	15.6	9.0	3,900	+	+	—
Deposit	Broome	Tap, public supply	2/ 1/12	2	Tr.	....	....	34	11	23	.026	.028	Tr.	0.60	1.40	1.50	15.6	6.0	120	+	—	—
Deposit	Broome	Tap, public supply	4/11/12	10	10	....	....	50	22	28	.010	.068	.001	0.40	1.20	0.75	11.1	2.0	300	+	+	+
Deposit	Broome	Tap, public supply	10/11/12	10	15	....	....	38	6	32	.004	.040	Tr.	0.24	1.80	1.00	20.8	13.0	27,000	+	+	....
Deposit	Broome	Tap, public supply	11/15/12	5	8	....	....	33	9	24	.012	.050	Tr.	0.50	0.90	1.00	19.5	9.0	500	+	+	+
Deposit	Broome	Tap, public supply	1/ 3/13	10	5	....	....	15	....	....	.026	.052	Tr.	0.30	1.70	1.25	11.1	6.0	950	+	+	—
Deposit	Broome	Tap, public supply	2/ 7/13	Tr.	Tr.	....	....	33	....	....	.018	.028	Tr.	0.60	1.20	1.50	16.9	5.0	150	+	—	—
Deposit	Broome	Tap, public supply	3/21/13	5	2	....	....	33	....	....	.016	.036	Tr.	0.50	1.50	0.75	11.1	4.0	600	—	—	—
Deposit	Broome	Tap, public supply	4/25/13	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	250	—	—	—
Deposit	Broome	Tap, public supply	6/ 7/13	5	5	....	....	36	....	....	.002	.040	Tr.	0.10	0.70	0.50	18.2	11.0	77,500	+	+	—
Deposit	Broome	Tap, public supply	7/18/13	10	2	....	....	37	....	....	.006	.068	Tr.	0.10	2.60	0.75	14.3	11.0	....	+	+	—
Deposit	Broome	Tap, public supply	4/ 2/14	Tr.	8	1 v.	1 v.	39	9	30	.050	.078	.001	0.60	1.80	1.50	7.9	2.0	1,900	+	+	—
Deposit	Broome	Collecting well, new reservoir	8/12/15	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	64,000	1+2—	1+2—	0+3—
Deposit	Broome	Tap, public supply	8/12/15	1	5	3 v.	3 v.	64	10	30	.002	.032	.001	0.24	1.60	0.75	26.0	4.0	12,500	1+2—	2+1—	0+3—

DUNKIRK

HERMANN M. BIGGS, M.D., *State Commissioner of Health:*

A reinspection of the public water supply of Dunkirk was made on January 26, 1915, by Dr. John J. Mahoney, sanitary supervisor of District "M" and the following facts are based largely upon the data obtained by him. An earlier report on an inspection of this water supply made in 1908 by Prof. H. N. Ogden in connection with his investigation of the sanitary conditions of this city will be found on page 719, volume 2 of the twenty-ninth annual report of this Department.

The water supply of this city is derived by pumping from Lake Erie directly into the distribution system. The intake extends about one-half mile into the lake to the west and beyond the breakwater which forms the harbor of the city. Conditions remain the same with respect to this supply as at the time of the previous inspection except that the water is now sterilized by liquid chlorine. The apparatus used for the application of the chlorine is that designed and furnished by the Electro-Bleaching Gas Company and has been in operation since May 4, 1914. The chlorine is applied at the rate of one pound per million gallons of water or 0.12 parts per million by weight.

The earlier report on this water supply pointed out very clearly the opportunities for contamination of the supply, either by the sewage of Fredonia brought into the lake by the Canadaway creek and carried to the intake by the west wind, or by the sewage of Dunkirk itself discharged directly into the harbor and carried to the intake by easterly or southerly winds.

That such sewage contamination has taken place is evidenced by the existence of high typhoid death rates in this city in the past. The following table gives the typhoid death rate, per 100,000 population, in Dunkirk in the past five years in contrast with the rate in the whole State:

TABLE I

TYPHOID DEATH RATE PER 100,000 POPULATION

	Year				
	1910	1911	1912	1913	1914
Dunkirk	33	17	17	68	41
State of New York	15.0	14.0	11.8	10.5	8.8

This table shows the excessive amount of typhoid which has occurred in Dunkirk which undoubtedly has been due to the infection of the public water supply.

During the first six months of 1914 there were some 150 cases of typhoid in Dunkirk.

The following table gives the number of cases reported by months for the years 1913 and 1914:

TABLE II

CASES OF TYPHOID REPORTED BY MONTHS FROM THE CITY OF DUNKIRK

	J	F	M	A	M	J	J	A	S	O	N	D	Total
1913	2	7	2	5	6	2	3	5	2	2	2	5	43
1914	8	5	26	54	50	17	1	1	0	1	0	0	163

This table shows clearly the epidemic prevalence of typhoid during both 1913 and 1914. The most striking fact, however, brought out by this table is the almost immediate checking of the disease by the installation of the sterilization apparatus in May, 1914, after a reasonable period of time had elapsed for the elimination of secondary cases. In view of the previous continued prevalence of typhoid it would appear that the almost entire elimination of the disease in Dunkirk can be attributed to the sterilization of the water supply. Notwithstanding this result, sterilization alone cannot be

considered as affording at all times and under all conditions sufficient protection to eliminate the possibility of infection. Such protection would be afforded to a much greater degree by filtration with the sterilization as supplementary treatment, especially under the conditions existing at Dunkirk.

In order to improve conditions in connection with the water supply it was recommended by Professor Ogden that one or more of the following remedies be employed:

1. The extension of the intake pipe into the lake to a point beyond the reach of pollution.
2. Filtration of the water supply.
3. Purification of the sewage of Fredonia.
4. Collection of the sewage of Dunkirk in an intercepting sewer and the discharge of this sewage at some point to the east where such discharge could be made without having any effect on the quality of the water supply.

Plans for the installation of a sewage disposal plant at Fredonia have been approved by this Department and plans are now being prepared for intercepting sewers and sewage disposal works for the city of Dunkirk, and it is expected that such plants will be constructed sometime in the near future. Although the intake of the water works has not been extended nor has the filtration been installed, it is evident that the city has made some attempt to improve the quality of their supply by means of sterilization.

Samples of both raw and sterilized water were collected by Dr. Mahoney at the time of his inspection and the results of the analyses of these samples together with others made in the past by the Division of Laboratories and Research will be found in the appended table. These analyses show a water supply somewhat colored, comparatively hard and at times very turbid. Previous to the installation of the chlorination apparatus the total number of bacteria were often very high and organisms of the B. coli type were uniformly present in 10 c. c., frequently in 1 c. c. and occasionally in 1/10 c. c. These analyses show clearly the unsatisfactory sanitary quality of the raw water supply of Dunkirk. Chlorination has apparently diminished the total number of bacteria of the B. coli type although the analyses made since sterilization has been practiced have been too few to show without question that such is the case at all times and under all conditions.

According to experience elsewhere the amount of chlorine added to the water would appear to be insufficient to effectively destroy any large percentage of the bacteria present in the raw water, especially in view of the relatively high organic content of the water. Furthermore, with effective sterilization the bacteria should be consistently reduced to smaller numbers than are shown by the analyses of the treated water in the present instance. It is usually considered advisable that the amount of chlorine used shall not be materially less than two pounds per million gallons of water giving a rate of 0.25 parts per million by weight.

The efficiency of all methods of sterilization depends upon the care and skill with which it is operated and as the degree of purification obtained can be determined only by bacterial analyses, it is very desirable, if not essential, that such analyses be made regularly and at frequent intervals.

Although efficient sterilization will prevent a recurrence of water-borne typhoid epidemics in Dunkirk, it must be noted that such sterilization will effect no improvement in the physical quality of the water. In order to remove the turbidity which is practically always present some form of filtration must be resorted to.

In view of the above facts the following conclusions may be drawn:

1. That the city authorities have taken some action along the lines recommended by this Department both by the installation of a sterilization apparatus and the preparation of plans for sewage disposal.
2. That the long continued excessive typhoid rates in Dunkirk have been due largely to the public water supply polluted by the sewage of both Fredonia and Dunkirk.

3. That the treatment of the sewage of Fredonia and Dunkirk as proposed will decrease the amount of pollution reaching the water supply.
4. That sterilization with liquid chlorine if carried out thoroughly at all times under careful supervision and with adequate amounts of chlorine will afford a water supply of comparatively satisfactory quality.
5. That the present amount of chlorine added to the supply is insufficient to properly sterilize it under all conditions
6. That in order to procure a water of satisfactory physical quality the water should be subjected to filtration.

I would, therefore, suggest that the following recommendations be made to the city authorities:

1. That the city proceed to construct the proposed sewage disposal plant at the earliest possible date after the plans have been completed and approved by this Department.
2. That the operation of the water sterilization process be controlled by frequent and regular bacteriological analyses.
3. That the amount of chlorine applied to the raw water be increased to at least two pounds per million gallons or to such greater amount as further analyses may indicate as necessary.
4. That the city authorities consider the installation of a filtration plant in order to improve the esthetic quality of the water, and better assure its sanitary quality.

Respectfully submitted
THEODORE HORTON,
Chief Engineer

ALBANY, N. Y., *March* 18, 1915

RESULTS OF WATER ANALYSES

Abbreviations used to describe odors of water: 0, none; 1, very faint; 2, faint; 3, distinct; 4, decided; 5, strong; 6, very strong; a, aromatic; d, disagreeable; e, earthy; f, fishy; g, grassy; m, musty; v, vegetable

Municipality	County	Source of sample	Date of collection	Physical				Chemical (Parts per Million)											Bacteriological			
						Odor		Solids			Nitrogen as—						Hardness			B. Coli Type + = present — = absent		
				Color	Turbidity	Cold	Hot	Total	Loss on ignition	Mineral residue	Free ammonia	Albuminoid ammonia	Nitrites	Nitrates	Oxygen consumed	Chlorine	Total	Alkalinity	Bacteria per c.c.: gelatin 20°, 48 hours	10 c.c.	1 c.c.	1-10 c.c.
Dunkirk	Chautauqua	Tap, public supply	1/23/09	2	22	....	....	145	40	105	.044	.316	.001	0.06	1.95	6.50	88.6	88.0	22,500	+	—	—
Dunkirk	Chautauqua	Tap, public supply	5/17/09	1	30	....	....	144	36	108	.020	.240	.001	0.24	2.05	8.12	82.9	82.0	425	+	—	—
Dunkirk	Chautauqua	Tap, public supply	3/22/10	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	3,200	+	+	+
Dunkirk	Chautauqua	Tap, public supply	5/24/10	5	15	....	....	169	33	136	.002	.026	.001	.004	1.20	7.00	97.2	85.0	25	—	—	—
Dunkirk	Chautauqua	Tap, public supply	10/10/10	5	10	....	....	147	49	98	.006	.104	.002	Tr.	1.90	6.25	97.1	95.0	32,500	+	+	—
Dunkirk	Chautauqua	Tap, public supply	12/14/10	15	60	....	....	228	48	180	.008	.060	.001	.010	2.90	6.25	98.6	93.0	500	+	+	—
Dunkirk	Chautauqua	Tap, public supply	2/ 1/11	12	30	....	....	142	51	91	.012	.092	.003	0.10	1.20	6.87	91.4	91.0	1,100	+	+	—
Dunkirk	Chautauqua	Tap, public supply	4/17/11	15	25	....	....	160	34	126	.012	.070	.002	0.10	2.00	7.50	101.5	96.0	650	+	—	—
Dunkirk	Chautauqua	Tap, public supply	6/ 6/11	Tr.	10	....	....	146	33	113	.018	.098	.001	0.10	2.70	7.50	98.0	89.5	500	+	—	—
Dunkirk	Chautauqua	Tap, public supply	11/ 3/11	10	50	....	....	182	26	156	.010	.102	.001	0.04	2.80	8.85	108.6	99.0	325	+	+	—
Dunkirk	Chautauqua	Tap, public supply	12/ 6/11	15	50	....	....	148	22	126	.006	.120	.001	0.06	3.10	6.75	122.8	91.0	17,500	+	+	—
Dunkirk	Chautauqua	Tap, public supply	2/28/12	5	10	....	....	139	30	109	.004	.072	.001	0.14	1.30	7.75	94.2	90.0	1,100	+	—	—
Dunkirk	Chautauqua	Tap, public supply	4/16/12	15	30	....	....	142	26	116	.006	.062	.001	0.08	1.40	6.50	95.8	84.0	5,500	+	+	+
Dunkirk	Chautauqua	Tap, public supply	9/20/12	15	5	....	....	166	27	139	.004	.094	.001	0.06	2.50	7.50	102.8	88.0	200	+	+	—
Dunkirk	Chautauqua	Tap, public supply	12/14/12	15	40	....	....	166	26	140	.014	.084	.001	0.06	3.20	8.25	94.2	93.0	1,400	+	+	—
Dunkirk	Chautauqua	Tap, public supply	1/23/13	10	50	1 v.	1 v.	166	....	....	.016	.116	.002	0.10	3.30	9.75	88.6	86.0	2,600	3+0—	1+2—	0+3—
Dunkirk	Chautauqua	Tap, public supply	2/20/13	10	10	2 v.	2 v.	144	....	....	.016	.072	Tr.	0.10	2.00	8.25	100.0	89.0	400	2+1—	0+3—	0+3—
Dunkirk	Chautauqua	Tap, public supply	4/ 3/13	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	1,800	3+0—	0+3—	0+3—
Dunkirk	Chautauqua	Tap, public supply	5/21/13	5	12	1 v.	1 v.	140	....	....	.018	.070	.001	0.06	1.60	7.75	108.8	92.0	300	1+2—	0+3—	0+3—
Dunkirk	Chautauqua	Tap, public supply	7/10/13	5	10	1 v.	1 v.	160	....	....	.004	.076	.001	0.04	1.60	7.75	97.2	91.0	600	0+3—	0+3—	0+3—
Water supply chlorinated since May 4, 1914.																						
Dunkirk	Chautauqua	Tap, public supply	4/14/14	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	450	0+3—	0+3—	0+3—
Dunkirk	Chautauqua	Tap, public supply	5/14/14	5	25	1 a.	1 a.	159	26	133	.020	.108	.001	0.10	2.60	7.50	84.3	82.0	....	....	....	....
Dunkirk	Chautauqua	Tap, public supply	5/23/14	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	250	0+3—	0+3—	0+3—
Dunkirk	Chautauqua	Pumping station	5/29/14	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	55	0+3—	0+3—	0+3—
Dunkirk	Chautauqua	Tap, public supply	5/29/14	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	*1,700	0+3—	0+3—	0+3—
Dunkirk	Chautauqua	Raw water	1/26/15	7	12	1 v.	1 v.	133	8	125	.022	.076	.001	0.06	4.80	8.50	117.2	86.0	90	3+0—	0+3—	0+3—
Dunkirk	Chautauqua	Chlorinated water	1/26/15	7	12	1 v.	1 v.	136	23	113	.030	.068	.001	0.06	3.90	8.50	102.8	94.0	30	0+3—	0+3—	0+3—

* Ice melted in sample box.

EASTHAMPTON

Hermann M. Biggs, M.D., *State Commissioner of Health:*

An investigation of the water supply at Easthampton, L. I., was made by Mr. C. M. Baker, assistant engineer, on May 10, 1915.

Easthampton is situated on Long Island in Suffolk county and is on the Montauk branch of the Long Island railroad about 115 miles from New York City. It is not an incorporated village but is provided with water in accordance with the Town Law relative to the laying out of water districts. The native population of the water district or that during the winter is about 2,000, but during the summer months the population is increased to about 3,000 because of the large number of summer residents from the city.

The water supply is owned and operated by the Home Water Company of which Jeremiah Hunting is president and manager. The system consists of five driven wells from which the water is pumped into a standpipe whence it it distributed by gravity through the mains to the consumers. It is estimated that about 90 per cent. of the population of the district is served with water which corresponds to 1,800 consumers in the winter and 2,700 during the summer. The average daily consumption during the winter is about 120,000 gallons or 67 gallons per capita, when based on the number of consumers during that period, and reaches a maximum of about 1 million gallons during the months of July and August which is equivalent to a per capita rate of 370 gallons daily. The total yearly consumption amounts to about 80 million gallons. There are between 400 and 500 service taps of which about one-half are metered. The average pressure for domestic purposes is about 38 pounds per square inch, but in case of fire the valves are shifted so that the standpipe is shut off and the water is pumped directly into the mains under a higher pressure.

The wells, pumping plant and standpipe are located just outside the water district about three-quarters of a mile from the central part of the district. The water is obtained from two 8-inch and three 10-inch wells driven to a depth of about 117 feet through 6 feet of sand, 6 feet of clay and the remainder through sand. Two 50-horse power gas engines operate two pumps with a capacities of 850 gallons per minute, each. The pumps are located in a pit about 30 feet deep and have a suction lift of about 9 feet, the water thus standing about 78 feet deep in the wells. The pumps are operated as needed in order to maintain sufficient water in the standpipe, the water in the standpipe being maintained at a level not less than 40 feet high. The height of the standpipe is 100 feet and it has a capacity of 90,000 gallons, but since the elevation of the water is not allowed to drop below 40 feet the actual available storage is thus reduced to about 48,000 gallons. The water mains consist of 2.03 miles of 8-inch pipe, 1.58 of 6-inch, 0.76 of 5-inch, 7.52 of 4-inch and 1.34 of 2-inch, or a total of 13.23 miles. The mains are flushed occasionally but evidently not at regular intervals.

The population within a radius of one-quarter mile is about 15 people and within one-half mile 125, corresponding to densities of 75 and 158 per square mile respectively. The area beyond these limits and within the probable limits of the area of influence is sparsely settled. The engineer's cottage is located about 140 feet from the wells and a cesspool which receives the drainage from the kitchen about 115 feet from them. A privy with a removable wooden box is located at a distance of about 150 feet from the wells and a barn about 160 feet. There is a slight depression in the contour of the ground between the wells and these buildings, the slope of the ground being from the wells toward the north east or toward the barn. There are no other residences or inhabitants for a distance of nearly a quarter of a mile from the plant.

A sample of the water was collected and sent to the Division of Laboratories and Research for analysis, the results of which are as follows:

REPORT OF WATER ANALYSIS FOR EASTHAMPTON

Laboratory No.	
Source	Wells
Collected on	5/10/15
Color	tr.
Turbidity	cl.
Odor, cold	1v
Odor, hot	1v
Solids, total	45
Loss on ignition	22
Mineral residue	23
Ammonia, free	.002
Ammonia, Alb	.002
Nitrites	.001
Nitrates	0.60
Oxygen consumed	0.50
Chlorine	11.75
Hardness, total	9.5
Alkalinity	7.00
Iron	.15
Bacteria per c.c	*5,400
B. coli type 10 c.c.	—
B. coli type 1 c.c.	—
B. coli type 1/10 c.c.	—

* Sample delayed in transit.
Results are expressed in parts per million. + Present. — Absent.
Abbreviations used to describe odors of water: 0, none; 1, very faint; 2, faint; 3, distinct; 4, decided; 5, strong; 6, very strong; a, aromatic; d, disagreeable; e, earthy; f, fishy; g, grassy; m, musty; v, vegetable.

This analysis indicates only a small amount of nitrogenous matter in the form of free and albuminoid ammonia and nitrites. Although the chlorine content, 11.75 parts per million is probably not much in excess of the normal, the nitrates, 0.60 parts per million are undoubtedly somewhat in excess of the normal. The bacterial content 5,400 per c. c. is excessively high for a well water but is doubtless due largely to the delay in transit, two days having elapsed from the time of collecting the sample until the time of analysis. Bacteria of the colon type were, however, absent.

There is evidence, therefore, in the relatively high nitrates that some contamination reaches the well and this is readily accounted for by the proximity of the cesspool and barn referred to. That the contamination was not active is indicated by the low ammonias and nitrites and the absence of B. coli and this is due to the purifying effect of the soil through which the water passes. There can be no guarantee, however, that this purifying effect can be always relied on to make the water safe and there is always the possibility under present conditions that this contamination may become active under excessive draught on the wells or unusual conditions of ground water flow.

In order, then to reduce the danger of active contamination to a minimum it is desirable to remove this cesspool to a point as far to the northeast as possible where the ground slope is away from and not toward the well and buildings; and it would also seem advisable to remove the barn as far from the wells as possible and thus obviate the possibility of pollution from this source. Precautions should also be taken to assure that the privy vault is at all times provided with a tight container and when cleaned that the contents are buried at some remote distance from the wells.

In conclusion I would state, that, although the analysis of the water taken from the Easthampton supply at the time of the inspection, indicates that dangerous contamination was not then active, a study of the analyses and of surrounding conditions indicates the possibility that during the summer when the consumption is greatly increased thus causing a much greater draught on the wells, or at other seasons when ground water conditions are different, contamination may become active and I would therefore recommend:

1. That the cesspool receiving the kitchen drainage be removed to a greater distance in fact as far as possible from the wells.

2. That the privy be provided with pails or other tight metallic containers in place of the wooden box and that when emptied the contents be carted away and buried at some remote distance from the well.

3. That the premises about the well, dwelling and barn be maintained at all times in a clean and sanitary condition.

4. That analyses be made from time to time to detect any active and dangerous contamination of the supply.

Respectfully submitted,

THEODORE HORTON,
Chief Engineer

ALBANY, N. Y., *May* 29, 1915

EAST SYRACUSE

HERMANN M. BIGGS, M.D., *State Commissioner of Health:*

A reinspection of the public water supply of East Syracuse was made in July, 1915, by Dr. F. W. Sears, sanitary supervisor of District "I." A previous inspection of this supply was made in 1908 by the engineering division, a report of which will be found on page 287, vol. 2 of the twenty-ninth annual report of this Department.

The public water supply of this village is derived from two surface streams located about 6½ miles south of the village and a supplementary supply is now obtained from a spring located about 4½ miles south of the village of Jamesville on a hillside in the town of Pompey. With the exception of this additional supply the water works system remains the same as described in detail in the earlier report. The water works are owned and operated by the municipality.

The total watershed area tributary to the two surface supplies is approximately 5 square miles and the total population thereon may be estimated at 150, or 38 per square mile. These streams flow for the most part through wooded lands and to some extent through a farming district. There is opportunity for contamination of the streams from surface wash from highways, manured fields, pasture lands and from the immediate vicinity of the various farm buildings. The spring supply in the town of Pompey, however, is so developed and situated that there seems to be no opportunity for its contamination.

The earlier report pointed out the possibilities for contamination of the two brooks and the following recommendations were made for the consideration of the village authorities that:

1. They should consider the propriety of increasing the available yield of Wright brook.

2. Measure should be taken to remove all existing sources of pollution on this watershed and to guard against their recurrence in the future.

3. The danger of pollution from the Gies farm can be abated by intercepting its drainage and diverting it to a point below the intake.

4. In regard to the Russ creek watershed, it appears that owing to the number of cases of pollution which would have to be removed and which would be difficult to control on account of their location, its abandonment should be considered. In case, however, it should appear impracticable from a further study of the situation to obtain sufficient supply from the Wright brook, it would be well to consider using a portion of Russ creek by extending a pipe line to a point above the highway bridge near the McDermott and Ladd places.

5. In case this is done a thorough inspection of the watershed above this intake point should be made and measures to remove all existing sources of pollution and to guard against their recurrence in the future should be taken.

6. In case they experience any difficulties in removing these sources of pollution or otherwise find it impracticable to thus clean up their watershed and protect their supply, to consider the question of application to this Department for the enactment of rules and regulations for the protection of their supply.

From the report of Dr. Sears it would appear that these recommendations have not been carried out in full although the need for them still exists. The results of the analyses of samples of this supply made in the past by the Division of Laboratories and Research will be found in the appended table. These results show a somewhat colored, at times turbid and very hard water. The figures for free and albuminoid ammonia, for nitrites and for oxygen consumed are somewhat high and variable, indicating considerable amounts of decomposing and decomposable organic matter. The chlorine and nitrate figures are also somewhat above the normal found in uncontaminated supplies. The bacterial counts are variable, in some cases very high, and the frequent occurrence of fecal organisms of the B. coli type in samples as small as 1 c. c. and occasionally in 1/10 c. c. shows clearly the active contamination of the supply from animal or human sources.

In view of the above facts, the following conclusions may be drawn:

1. That apparently the village authorities have not carried out in full the previous recommendations of this Department.

2. That the streams tributary to the present water supply of East Syracuse are open to contamination of animal and possibly of human origin, this contamination being due to surface wash from cultivated and manured fields, from pasture lands and from the vicinity of farm buildings.

3. That, as far as can be determined from the information at hand, the supply from the spring in the town of Pompey should be of a satisfactory sanitary quality if adequately protected from all sources of contamination.

I would therefore recommend:

1. That the village authorities give their immediate attention to the previous recommendations of this Department.

2. That, in order to avoid all dangers from contamination which are incidental to a populated watershed, the village install and carefully operate suitable apparatus for the sterilization of their supply with liquid chlorine.

Respectfully submitted,

THEODORE HORTON,
Chief Engineer

ALBANY, N. Y., *November* 20, 1915

Dr. Sears in a letter of December 6, 1915, furnishes the information that Russ creek now forms no part of the present water system of East Syracuse. This stream has been so diverted that it is no longer tributary to the supply.

RESULTS OF WATER ANALYSES

Abbreviations used to describe odors of water: 0, none; 1, very faint; 2, faint; 3, distinct; 4, decided; 5, strong; 6, very strong; a, aromatic; d, disagreeable; e, earthy; f, fishy; g, grassy; m, musty; v, vegetable

Municipality	County	Source of sample	Date of collection	Physical				Chemical (Parts per Million)											Bacteriological			
						Odor		Solids			Nitrogen as—						Hardness			B. Coli Type + = present − = absent		
				Color	Turbidity	Cold	Hot	Total	Loss on ignition	Mineral residue	Free ammonia	Albuminoid ammonia	Nitrites	Nitrates	Oxygen consumed	Chlorine	Total	Alkalinity	Bacteria per c.c.; gelatin 20°, 48 hours	10 c.c.	1-10 c.c.	1 c.c.
East Syracuse	Onondaga	Tap, public supply	3/8/09	1	13	....	....	227	38	189	.020	.170	.003	2.00	2.85	2.00	131	......	325	+	+	−
East Syracuse	Onondaga	Tap, public supply	6/25/09	1	15	....	....	257	50	207	.010	.034	.002	1.00	1.65	2.25	208	184	......	......	......	......
East Syracuse	Onondaga	Tap, public supply	11/20/09	5	1	....	....	276	36	240	.002	.020	.001	q	1.35	1.62	235	......	190	+	+	−
East Syracuse	Onondaga	Tap, public supply	2/19/10	....	....	....	....	....	....	....	....	....	....	....	....	......	......	......	325	+	−	−
East Syracuse	Onondaga	Tap, public supply	4/21/10	....	....	....	....	258	42	216	.006	.208	.002	0.50	4.20	2.25	183	......	1,600	+	+	−
East Syracuse	Onondaga	Tap, public supply	5/26/10	20	5	....	....	236	21	215	.010	.114	.003	0.70	5.00	2.00	215	168	3,040	......	......	......
East Syracuse	Onondaga	Tap, public supply	6/28/10	Tr.	5	....	....	227	31	196	.002	.010	.003	0.80	1.20	1.75	180	178	900	+	−	−
East Syracuse	Onondaga	Tap, public supply	9/ 9/10	5	12	....	....	247	55	192	.056	.096	Tr.	0.40	2.60	1.75	187	187	7,700	+	+	+
East Syracuse	Ongndaga	Tap, public supply	11/ 7/10	5	Tr.	....	....	256	34	222	.006	.060	Tr.	0.50	1.20	2.00	222	182	370	+	+	−
East Syracuse	Onondaga	Tap, public supply	12/21/10	Tr.	Cl.	....	....	274	59	215	.006	.028	.003	1.44	1.10	1.00	215	212	106	+	−	−
East Syracuse	Onondaga	Tap, public supply	1/19/11	1	Cl.	....	....	237	32	205	.002	.040	Tr.	1.00	0.90	1.75	215	193	1,500	+	+	−
East Syracuse	Onondaga	Tap, public supply	2/14/11	Tr.	5	....	....	245	32	213	.024	.056	.003	1.20	1.40	2.78	208	205	3,100	+	+	−
East Syracuse	Onondaga	Tap, public supply	5/26/11	5	3	....	....	244	32	212	.012	.070	.004	1.60	1.90	1.75	208	191	24,500	+	+	+
East Syracuse	Onondaga	Tap, public supply	7/ 8/11	2	5	....	....	251	49	202	.008	.034	.001	0.80	1.70	1.62	180	168	100	+	−	−
East Syracuse	Onondaga	Tap, public supply	9/12/11	Tr.	5	....	....	159	22	137	.004	.054	.001	0.06	3.10	2.25	105	103	300	+	+	−
East Syracuse	Onondaga	Tap, public supply	10/25/11	Tr.	Cl.	....	....	322	47	275	.022	.062	.001	0.72	0.50	2.50	160	172	400	+	−	−
East Syracuse	Onondaga	Tap, public supply	11/22/11	10	1	....	....	278	40	238	.004	.038	.004	0.90	1.40	2.25	236	208	650	+	+	−
East Syracuse	Onondaga	Tap, public supply	1/12/12	5	5	....	....	294	50	244	.008	.032	.001	1.60	1.10	2.62	229	219	375	+	−	−
East Syracuse	Onondaga	Tap, public supply	2/16/12	5	3	....	....	258	16	242	.016	.038	Tr.	1.44	0.80	2.25	236	210	50	+	−	−
East Syracuse	Onondaga	Tap, public supply	4/ 3/12	10	20	....	....	223	26	197	.018	.072	.001	1.36	1.30	1.75	189	162	1,600	+	+	+
East Syracuse	Onondaga	Tap, public supply	4/27/12	5	Tr.	....	....	232	31	201	.002	.052	.001	1.08	1.10	2.25	200	175	20	−	−	−
East Syracuse	Onondaga	Tap, public supply	10/ 9/12	5	Tr.	....	....	267	41	226	.002	.044	.001	0.80	2.00	1.75	215	203	500	+	−	−
East Syracuse	Onondaga	Tap, public supply	11/26/12	5	Tr.	....	....	259	22	237	.014	.070	.001	1.20	1.40	2.25	222	216	170	+	+	−
East Syracuse	Onondaga	Tap, public supply	1/31/13	Tr.	Cl.	....	....	236	....	....	.008	.040	.001	1.40	0.90	2.75	215	201	50	−	−	−
East Syracuse	Onondaga	Tap, public supply	2/20/13	Tr.	Cl.	....	....	242	....	....	.006	.042	Tr.	1.40	1.00	2.50	222	205	30	−	−	−
East Syracuse	Onondaga	Tap, public supply	4/ 2/13	5	5	....	....	212	....	....	.016	.046	001	1.20	1.50	1.75	189	175	240	−	−	−
East Syracuse	Onondaga	Tap, public supply	5/14/13	Tr.	2	....	....	233	....	....	.004	.046	Tr.	0.60	1.80	1.50	195	189	80	−	−	−
East Syracuse	Onondaga	Tap, public supply	5/19/14	5	Tr.	1 a.	1 a.	226	26	206	.004	.052	.002	1.20	2.20	1.75	189	180	450	+	+	−

EAST WORCESTER

HERMANN M. BIGGS, M.D., *State Commissioner of Health:*

Reinspections of the public water supply of the village of East Worcester were made on May 11, 1915, by Dr. C. C. Duryee, sanitary supervisor of District "C," and on June 2, 1915, by Mr. E. S. Chase, assistant engineer in this Department. An earlier investigation of this supply was made in 1910 by the Engineering Division, the report of which will be found on page 653 of the thirty-first annual report of this Department.

The water supply of this village is derived from Oak creek, the intake being located about one mile north of the center of the village. Since the time of the investigation in 1910 a pressure mechanical filter has been installed; otherwise the description of the intake, reservoir and water works system in general remains practically the same as described in the earlier report. The water works are owned and operated by the East Worcester Water Works Company, of which Mr. William F. Shupe of East Orange, N. J., is president and Mr. G. T. Jennings of East Worcester is superintendent.

The watershed of Oak creek above the point of intake is approximately 8.8 square miles in area. The resident population on this watershed may be estimated at approximately 300, or 34 per square mile. This area is devoted mainly to farming and contains comparatively small areas of woodland. A great deal of the area is devoted to pasture land and there are a great many head of cattle pastured there. There are several large swamps and two or three large shallow ponds on the watershed, although on the whole the slopes are steep and the run-off rapid. The majority of houses are located well back from the stream or its tributaries, although in a few instances there are privies so located that there is possibility of contamination of the stream at times of rainfall.

The description of the intake is practically the same as described in detail in the earlier report except that now the water is delivered to the filter before passing into the village mains. This filter is housed in a substantial concrete building about 500 feet below the emergency reservoir. This filter is of the typical pressure type manufactured by the Continental Jewell Filtration Company and was installed in the fall of 1911. Its exact dimensions are not known, although it is approximately 10 feet in diameter and 12 feet in length. Little information is available in respect to the details of its construction and operation. Alum is used as a coagulant and is applied by means of the well known shunt system. The superintendent stated that the alum cylinder was filled up once in every three or four months, but he had no idea of the actual amount of alum used. It seems probable therefore that most of the alum goes into solution within a short time after the filling of the cylinder and that during the greater portion of the time little if any coagulation occurs. The filter is cleaned once a day by reverse flow. Washing continues for about 10 or 15 minutes, but at an unknown rate. After washing, the first filtrate is wasted for about five minutes.

At the time of the earlier report it was pointed out that the supply, from an esthetic standpoint, owing to extensive swamps and the deterioration of the supply due to the organic matter from this source, was unfit for use, and that, in view of the pollution on the watershed, the supply was unsafe to use without purification. It was therefore recommended that steps be taken to remove the various sources of pollution, in case of necessity applying to this Department for the enactment of rules and regulations for the sanitary protection of the watershed, and that steps be taken to improve the esthetic quality of the water by draining the swamps or by corrective measures such as filtration.

From the reinspection of the supply it would appear that while the recommendations in respect to the sanitary control of the watershed have not been carried out the important one regarding the installation of a filter has been acted upon.

At the time of the inspection samples of filtered water were taken from a tap in the village and of the raw water stored in the emergency reservoir. These two samples are probably not quite comparable because the water in the reservoir had been subject to storage and there was apparently some

growth of algae. The results of these analyses together with others made in the past by the Division of Laboratories and Research will be found in the appended table.

These analyses show that the unfiltered water is high in color, occasionally turbid, high in total numbers of bacteria and with organisms of the B. coli type present in small inoculations. The analyses of the water since the installation of the filtration plant show that the color has been somewhat although not entirely removed, that the turbidity has also been reduced, and that the total number of bacteria are as a rule materially less than formerly, and that organisms of the B. coli type are of less frequent occurrence. The analyses however show that high efficiency of the filter is not at all times the case, for several of the samples of the filtered water show high bacterial counts and B. coli present in samples as small as 1 c. c. The reason for this inefficiency of filtration is evidently due to the improper and unskilled methods of operation. Without the use of adequate means of coagulation the proper action of a pressure mechanical filter is rarely obtained, and in the present instance it seems very clear that for a large part of the time little if any coagulant is applied to the raw water before filtration.

In view of the above facts, the following conclusions may be drawn:

1. That the East Worcester Water Company has taken steps to carry out the recommendations of this Department in regard to the installation of a filtration plant, but not in respect to improving conditions upon the watershed.

2. That this filtration plant is apparently capable of producing a satisfactory quality of effluent provided it is at all times carefully operated and provided the sanitary quality of the raw water is protected as far as possible by the elimination of direct sources of pollution on the watershed.

3. That the present uncertain and unsatisfactory method of applying alum tends to preclude the accomplishment by the filter of as high a degree of purification as circumstances demand.

4. That the conditions on the watershed tributary to this supply are such as to bring about a certain amount of contamination of the supply from surface wash at times of rainfall, from pastures, manured land, barnyards, and in some cases from privies. In addition there is the ever present possibility of contamination of an accidental, incidental or wilful nature which exists upon all well populated watersheds.

In view of the above conclusions, the following recommendations may be made:

1. That the East Worcester Water Company have frequent and regular inspections made of the watershed in order to detect and remove any sources of permanent contamination which may exist, and in case of difficulty apply to this Department for the enactment of rules and regulations for the sanitary protection of the water supply.

2. That the water company apply alum to the raw water more constantly and in greater quantities in order that efficient coagulation may be produced for the proper operation of the filter.

3. That the water company install some method of measuring the rate of filtration of the filter in order to determine the necessary amount of alum to be added, or else provide for daily tests of alkalinity and turbidity to serve as guides in the operation of the filter.

In view of the obvious lack of efficient operation of the filter plant, as above pointed out, and to the prime importance of this feature as affecting the safety of the water supply, it is suggested that the water company follow out the plan which is now being quite generally adopted by the more progressive water works managements in this State, of engaging the services of a competent consulting expert to make occasional visits to the plant during the year to study the local conditions and operation of the filters and give detailed advice as to the best methods to employ to improve the operation of the plant and maintain it at its highest efficiency.

Respectfully submitted,
THEODORE HORTON,
Chief Engineer

ALBANY, N. Y., *June 16, 1915*

RESULTS OF WATER ANALYSES

Abbreviations used to describe odors of water: 0, none; 1, very faint; 2, faint; 3, distinct; 4, decided; 5, strong; 6, very strong; a, aromatic; d, disagreeable; e, earthy; f fishy; g, grassy; m, musty; v, vegetable

Municipality	County	Source of sample	Date of collection	Physical				Chemical (Parts per Million)												Bacteriological			
						Odor		Solids			Nitrogen as—						Hardness			Bacteria per c.c.; gelatin 20°, 48 hours	B. Coli Type + = present — = absent		
				Color	Turbidity	Cold	Hot	Total	Loss on ignition	Mineral residue	Free ammonia	Albuminoid ammonia	Nitrites	Nitrates	Oxygen consumed	Chlorine	Total	Alkalinity		10 c.c.	1 c.c.	1-10 c.c.
East Worcester	Otsego	Tap, public supply	3/21/11	5	1	....	....	62	15	47	.018	.060	.001	.070	1.50	2.50	36.0	16.0	350	+	—	—
East Worcester	Otsego	Tap, public supply	5/ 4/11	0	Cl.	....	....	30	17	13	.016	.050	.003	.070	0.30	1.00	12.7	9.0	50	+	—	—
East Worcester	Otsego	Tap, public supply	7/20/11	30	Tr.	....	....	35	12	33	.004	.104	.001	.010	5.30	0.75	22.1	16.0	2,100	+	+	+
East Worcester	Otsego	Tap, public supply	9/ 5/11	30	5	....	....	61	15	39	.050	.134	.003	.010	2.00	1.00	22.0	19.0	500	+	+	—
East Worcester	Otsego	Tap, public supply	10/10/11	10	Tr.	....	....	59	13	41	.026	.069	.003	.014	1.90	1.25	33.8	25.0	200	+	+	—
Filter installed in fall of 1911.																						
East Worcester	Otsego	Tap, public supply	4/11/13	10	Tr.	....	....	52	21	31	.012	.042	.001	0.24	0.20	0.75	18.2	10.0	100	—	—	—
East Worcester	Otsego	Tap, public supply	9/19/12	15	Cl.	....	....	56	16	40	.002	.044	Tr.	0.20	2.20	1.00	29.9	25.0	130,000	+	+	—
East Worcester	Otsego	Tap, public supply	11/16/12	10	Cl.	....	....	45	15	30	.006	.082	.001	0.36	2.60	0.75	19.5	12.0	70	+	—	—
East Worcester	Otsego	Tap, public supply	3/ 4/13	Tr.	Cl.	....	....	33	....	....	.014	.036	Tr.	0.40	1.30	1.12	19.6	7.0	80	—	—	—
East Worcester	Otsego	Tap, public supply	4/29/13	5	Tr.	....	....	48	....	....	.004	.038	.001	0.14	1.20	0.75	19.5	11.0	650	+	+	—
East Worcester	Otsego	Tap, public supply	6/10/13	Tr.	Tr.	....	....	44	....	....	.004	.016	Tr.	0.16	0.70	0.50	20.8	15.0	20	—	—	—
East Worcester	Otsego	Tap, public supply	5/11/15	5	Cl.	1 v.	1 v.	22	3	19	.002	.040	.001	0.16	3.20	0.25	18.2	15.0	30	1+2—	0+3—	0+3—
East Worcester	Otsego	Tap, public supply	5/11/15	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	20	2+1—	0+3—	0+3—
East Worcester	Otsego	Raw water, reservoir	6/ 2/15	5	5	2 v.	2 v.	75	29	46	.008	.110	.001	0.01	4.10	0.38	23.4	17.0	30	0+3—	0+3—	0+3—
East Worcester	Otsego	Tap, filtered water	6/ 2/15	Tr.	Cl.	2 v.	2 v.	50	21	29	.008	.038	.001	0.24	2.30	0.38	23.1	21.0	15	0+3—	0+3—	0+3—

ELLENVILLE

HERMANN M. BIGGS, M.D., *State Commissioner of Health:*

A reinspection of the public water supply of Ellenville was made on September 1, 1915, by Dr. C. W. Berry, sanitary supervisor of District "N." A previous investigation of this supply was made in 1908 by the Engineering Division, the full report of which will be found on page 290, volume 2, of the twenty-ninth annual report of this Department.

The water supply is furnished by the municipality from two mountain brooks, known as the North and South Gully brooks respectively, and from a well located in the village within a few feet of Sandburg creek. The water works were installed in 1851 and at present consist of a small covered reservoir on the South Gully brook, two reservoirs on the North Gully brook and a pumping station at the well in the village. There are about two miles of mains ranging in size from 4 to 10 inches in diameter through which the water is supplied at an average pressure of about 60 pounds per square inch. The average daily consumption is about 350,000 gallons.

The South Gully brook has a watershed of about two square miles. Upon this area there are two large summer hotels, the Cragsmoor settlement, and about a dozen dwellings, giving a total population of 500 during the summer months. The area is very steep and precipitous and is well wooded. The reservoir into which a portion of the flow of the brook is diverted is constructed of masonry and concrete and has a capacity of about 3,600 gallons.

There are many chances for pollution of this brook although it is claimed by the board of water commissioners that the sanitary conditions are well looked after during the summer. A new sewer system has been installed at the Mongolia House, leading the drainage in the opposite direction from the stream. Conditions at the Mount Meenaga House have also been improved and all privies and manure pits near this stream have been visited and cared for during the warm months. There are no regular inspections of the watershed, the members of the board visiting it from time to time, and beyond improvements in one or two of the worst places very little cleaning-up work has been done. It is evident that with the large summer population upon this watershed more or less pollution of the South Gully brook constantly occurs during the summer.

The drainage area of the North Gully brook is about two square miles in area and is completely uninhabited. This area consists of steep, well wooded slopes. A portion of this stream is diverted into a distributing reservoir 30 x 60 x 20 feet deep with a capacity of 320,000 gallons. Above this reservoir, on the south bank of the stream an additional reservoir was constructed in 1910, by blasting out an excavation in solid rock and constructing end walls of concrete. This reservoir is approximately 40 x 90 feet in plan and has a capacity of about 2,000,000 gallons. The elevation of this reservoir is so great that the water used from it is conveyed through a bypass before entering the distributing mains in order to prevent excessive pressure on the water mains.

The well in the village near Sandburg creek is about 20 x 12 feet in plan and approximately 25 feet deep. The walls are laid up with rough stone, with open seams and capped with a concrete wall extending 2 feet above the surface of the ground. The top of the wall is covered by a wooden roof. The well extends through soil composed entirely of sand and gravel. It is extremely probable that this well is fed largely by water infiltering from the nearby creek. The water from this well is pumped directly into the mains at such times as it is necessary to supplement the gravity supply from the upland brooks.

It was the intention of the board of water commissioners when the new reservoir was constructed on the North Gully brook to use this supply entirely, and this had been done until a heavy storm in the middle of last August caused a flood in the brook which carried away some of the water mains leading from this supply. At the time of the inspection repairs were being made as rapidly as possible. The supply at that time was being obtained from the South Gully brook and from the well in the village.

At the time of the earlier inspection the numerous opportunities for serious contamination of the South Gully brook supply were pointed out. It was also pointed out that the water in the well in the village was liable to pollution due to imperfect filtering of the creek water. It was therefore recommended that:

1. A thorough inspection of the entire watershed of the South Gully brook and its branches should be made.
2. Measures should be taken to remove all existing sources of pollution on this watershed and to guard against their recurrence in the future.
3. In case they experience any difficulties in removing these sources of pollution or otherwise find it impracticable to thus clean up their watershed and protect their supply, to consider the question of application to this Department for the enactment of rules and regulations for the protection of their water supply.

From the report of Dr. Berry it would appear that the local authorities have taken steps to carry out recommendations 1 and 2 although as yet no application has been made to this Department for the enactment of rules and regulations. The construction of the well near Sandburg creek was directly contrary to the advice given in this earlier report.

At the time of the inspection Dr. Berry collected samples of water from the South Gully brook and from the well, and the results of the analyses of these samples together with others made in the past by the Division of Laboratories and Research will be found in the appended table.

These analyses show a water usually clear, moderately colored and fairly soft. The figures for nitrogen in its various forms are somewhat variable and indicate amounts of decomposing and decomposable organic matter. In some cases the bacterial counts are excessive and fecal organisms of the B. coli type present in samples as small as 1/10 c. c. indicating active contamination by animal or human wastes. These unsatisfactory results may have been obtained at such times as the water in the mains consisted of a mixture of water from the South Gully brook, or from the well in the village, with the water from the North Gully brook since the few analyses of individual samples from the different sources of supply show that the water derived from both the South Gully brook and the well are decidedly unsatisfactory from the sanitary viewpoint. In view of the above facts the following conclusions may be drawn:

1. That the village authorities of Ellenville have acted in accordance with the recommendations of this Department in removing certain sources of contamination on the South Gully watershed and also in their endeavor to use the water from the North Gully supply altogether.
2. That the village authorities have not requested the enactment of rules and regulations for the sanitary protection of their water supply as advised.
3. That the development and use of the well in the village near the polluted Sandburg creek are directly contrary to the advice of this Department.
4. That, as clearly pointed out in the earlier report, the water derived from both South Gully brook and the well in the village are of a decidedly unsatisfactory sanitary quality.

I would, therefore, recommend:

1. That the village authorities continue to take every precaution to maintain the water supply derived from North Gully brook free from all contamination and that the supply be continued as the permanent source of water supply for the village.
2. That, when used, the auxiliary supplies from South Gully and the well be sterilized by liquid chlorine or else these supplies be abandoned and a new auxiliary supply of unquestioned sanitary quality be developed.

Respectfully submitted,
THEODORE HORTON,
Chief Engineer

ALBANY, N. Y., *October* 26, 1915

RESULTS OF WATER ANALYSES

Abbreviations used to describe odors of water: 0, none; 1, very faint; 2, faint; 3, distinct; 4, decided; 5, strong; 6, very strong; a, aromatic d, disagreeable; e, earthy; f, fishy; g, grassy; m, musty; v, vegetable

Municipality	County	Source of sample	Date of collection	PHYSICAL				CHEMICAL (PARTS PER MILLION)											BACTERIOLOGICAL			
						ODOR		SOLIDS			NITROGEN AS—						HARDNESS			B. COLI TYPE + = PRESENT − = ABSENT		
				Color	Turbidity	Cold	Hot	Total	Loss on ignition	Mineral residue	Free ammonia	Albuminoid ammonia	Nitrites	Nitrates	Oxygen consumed	Chlorine	Total	Alkalinity	Bacteria per c.c.; gelatin 20°; 48 hours	10 c.c.	1 c.c.	1-10 c.c.
Ellenville	Ulster	Tap, public supply	2/ 8/09	1	Cl.	....	....	32	13	19	.056	.064	Tr.	Tr.	1.15	1.12	9.5	4.0	38	−	−	−
Ellenville	Ulster	South Gully Brook	9/ 5/09	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	26,000	+	+	+
Ellenville	Ulster	Tap, public supply	5/17/11	Tr.	Cl.	....	....	37	17	20	.012	.038	.001	0.04	0.90	1.37	18.2	10.0	500	+	−	−
Ellenville	Ulster	Tap, public supply	10/24/11	10	2	....	....	23	11	12	.014	.052	.001	0.04	2.10	1.00	11.1	2.0	200	+	+	−
Ellenville	Ulster	Tap, public supply	2/27/12	1	Cl.	....	....	63	10	53	.006	.026	Tr.	0.04	1.10	0.75	19.5	8.0	300	−	−	−
Ellenville	Ulster	Tap, public supply	7/ 5/12	Tr.	Cl.	....	....	67	21	46	.002	.004	.001	0.20	0.20	1.50	39.0	32.0	5,500	+	+	+
Ellenville	Ulster	Tap, public supply	7/16/12	Tr.	Cl.	....	....	69	16	53	.002	.016	.001	0.16	0.20	2.25	45.7	41.0	76,500	+	+	−
Ellenville	Ulster	South Gully Brook	9/18/12	Tr.	Cl.	....	....	75	17	59	.002	.008	.001	0.02	0.70	2.25	22.5	21.0	100,000	+	+	−
Ellenville	Ulster	Tap, public supply	10/ 8/12	5	Cl.	....	....	77	13	64	.004	.022	Tr.	0.42	0.70	2.00	50.0	48.0	650	−	−	....
Ellenville	Ulster	Tap, public supply	11/13/12	8	Cl.	....	....	35	14	21	.020	.052	Tr.	0.02	2.00	1.50	18.2	8.0	400	+	+	−
Ellenville	Ulster	Tap, public supply	1/ 1/13	Tr.	Cl.	....	....	38	....	....	.018	.046	Tr.	0.02	1.20	1.75	18.2	8.0	40	−	−	−
Ellenville	Ulster	Tap, public supply	2/ 5/13	Tr.	Cl.	....	....	37	....	....	.012	.034	Tr.	0.02	1.50	1.25	12.7	7.0	60	−	−	−
Ellenville	Ulster	Tap, public supply	3/14/13	5	Cl.	....	....	30	....	....	.010	.018	Tr.	0.02	0.90	0.75	16.5	8.0	130	−	−	−
Ellenville	Ulster	Tap, public supply	4/18/13	Tr.	Cl.	....	....	26	....	....	.028	.016	.001	0.02	1.10	1.12	15.6	5.0	80	−	−	−
Ellenville	Ulster	Tap, public supply	5/31/13	Tr.	Tr.	....	....	58	....	....	.014	.024	Tr.	0.02	1.30	0.62	16.9	10.0	900	−	−	−
Ellenville	Ulster	Tap, public supply	7/10/13	Tr.	Cl.	....	....	46	....	....	.004	.018	Tr.	0.02	0.70	1.25	28.6	27.0	500	+	−	−
Ellenville	Ulster	Tap, public supply	10/16/13	5	Tr.	....	....	58	11	47	.004	.032	.001	0.04	2.50	1.62	24.7	15.0	200	+	−	−
Ellenville	Ulster	South Gully Brook	10/16/13	Tr.	Tr.	....	....	36	6	30	.004	.020	.001	0.04	2.10	1.87	26.0	16.0	275	+	+	−
Ellenville	Ulster	Tap, public supply	3/25/14	Tr.	Cl.	1 v.	1 v.	23	9	14	.006	.020	.001	0.04	1.30	0.87	12.7	7.0	30	−	−	−
Ellenville	Ulster	Tap, public supply	9/ 2/14	Tr.	Cl.	1 v.	1 v.	69	10	59	.002	.006	Tr.	0.06	1.00	0.75	47.1	45.0	2,400	−	−	−
Ellenville	Ulster	Tap, public supply	7/ 9/15	Tr.	Tr.	1 a.	1 a.	75	28	47	.002	.038	Tr.	Tr.	2.00	1.00	16.9	10.0	6,100	+	+	−
Ellenville	Ulster	Tap, well being used	9/15/15	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	12,000	+	+	+
Ellenville	Ulster	South Gully Brook	9/ 1/15	3	30	1 a.	1 a.	90	14	76	.016	.032	.001	0.04	1.90	2.50	19.5	8.0	....	....	....	....
Ellenville	Ulster	Well	9/ 1/15	3	Tr.	1 a.	1 a.	93	9	84	.020	.028	.004	0.80	2.00	3.00	26.0	14.0	22,000	3+0−	3+0−	0+3−

ELLICOTTVILLE

Hermann M. Biggs, M.D., *State Commissioner of Health:*

A reinspection of the public water supply of Ellicottville was made on February 17, 1915, by Dr. J. J. Mahoney, sanitary supervisor of District "M". A previous investigation of this supply was made by the Engineering Division in 1912, a full report of which will be found on page 659 of the thirty-third annual report of this Department. In 1913, a further inspection of the supply was made by the Engineering Division in connection with an investigation of an outbreak of typhoid fever in the village. The report of this later investigation will be found on page 743 of the thirty-fourth annual report of the Department.

The public water supply of Ellicottville is derived partly by gravity from a group of springs and two flowing wells in the hills west of the village and partly by pumping from driven wells near Great Valley creek, in the south western part of the village. In general the water works system remains the same as at the time of the earlier reports. The water works are owned and operated by the Ellicottville Water Company.

The new wells described in the 1913 report are located in the pumping station about 15 feet distant from the six wells formerly in use and which have been abandoned. These new wells were first put in use in the fall of 1913. There are two wells 62 feet deep, and two 38 feet deep. The 62-foot wells are connected to a Worthington pump which has a capacity of 400 gallons per minute and the 38-foot wells are connected with a Snow pump. The latter wells are used only at times of emergency. All the wells have 6-inch cast iron casings extending 2 feet above the floor of the pumping station and to the bottom of the wells. The strata through which the wells pass consists of a few inches of top soil, about 32 feet of gravel, 7 to 8 feet of hard pan and a substrata of gravel.

At the time of the previous investigation the following conclusions were drawn:

1. That while it is improbable that all the cases of typhoid fever which have occurred are traceable to the public water supply, it is likely, by reason of the proximity of habitations and cesspools to the wells at the pumping station, together with the opportunities for chance infection at the Marsh springs and from the creek supply, that the water had been a contributory cause of the prevalence of the disease.
2. That the driven wells supply in the village, while in good sanitary condition at the time of inspection, is dangerously located, with reference to the population, on the immediate watershed and the proximity and elevation of cesspools.
3. That with the exception of an opportunity for surface wash from manured fields entering near the northwestern corner, the reservoir and surroundings were in a satisfactory sanitary condition at the time of inspection.
4. That there exists an opportunity for the pollution of the Marsh springs by animal polluted surface waters entering the springs and catch basin through the openings in the wooden bulkheads surrounding these basins.
5. That the presence of sediment in the distributing mains is due to the gradual settlement and accumulation of suspended matters at points of the system where there are dead ends or where the velocity of flow is small and should be corrected by a more frequent and more effective flushing of the mains.

In view of these conclusions it was recommended:

1. That the cesspool on the premises adjacent to and above the pumping station in the village be abandoned, disinfected and backfilled, and that the drainage from this dwelling be disposed of in such a manner as to prevent any possibility of pollution of the ground water supplying the public water supply wells.
2. That because of the undesirable location of the driven wells in the village in a populated region, and, further because of the likelihood of this area becoming more thickly populated accompanied by a correspond-

ing increase in the danger of pollution of the underground waters of the region, that the Ellicottville Water Company take action with a view to the abandonment of the present driven wells in the village, and the securing of a safe supplementary supply from wells more favorably situated or from other suitable source.

3. That the basin at the Marsh springs be provided with masonry, concrete or other suitable watertight walls, in such a manner as to prevent any surface water entering directly into the public water supply.

4. That the reservoir be protected from all surface water from the hillside and manured fields above by adequate intercepting trenches to lead any surface wash below the reservoir.

5. That the intake from the creek at the Marsh springs be abandoned and disconnected from the public water supply.

6. That frequent and regular inspections be made by the water company of all the several sources of public water supply of the village in order to prevent any accidental or careless pollution of the public water supply.

In the report on the investigation of typhoid fever in 1913, it was further recommended that the village take up immediately the question of installing a proper sewerage system and sewage disposal plant, the need of which was obvious.

From the report of Dr. Mahoney it appears that recommendation No. 1 has not been carried out and recommendation No. 2 has been carried out in part only for the new wells are not located in a more favorable position. The recommendation relative to proper sewerage and sewage disposal by the village has not been acted upon. The other recommendations, however, have been carried out by the water company.

At the time of his inspection Dr. Mahoney collected samples from the wells and from a tap in the village and the results of the analyses of these samples together with others made in the past by the Division of Laboratories and Research will be found in the appended table.

These analyses show a water clear, colorless and hard. Unoxidized organic nitrogen as shown by the figures for free albuminoid ammonia is present in small amounts only. The figures for oxidized nitrogen in the form of nitrates are moderately high as are the figures for chlorine indicating a certain amount of organic contamination in the ground water supply, purified however, by passage through the soil. The total numbers of bacteria are low although organisms of the B. coli type have occurred in small quantities occasionally. These results indicate that at times active contamination has found its way into the supply. The few samples taken since 1913 show low bacterial counts and the absence of B. coli. The location of wells in a comparatively densely populated neighborhood renders them liable to active contamination at times of variation in the rate of pumping and increased draft upon the wells. In view of the above facts the following conclusions may be drawn and recommendations made.

1. That the water company has carried out several of the recommendations of the previous report although there still remain other improvements to be made.

2. That under certain hydrostatic conditions of the ground water it is possible that active contamination will reach the wells.

3. That as recommended in the previous report the cesspool on the premises adjacent to and above the pumping station of the village be abandoned.

4. That the water company have regular and frequent analyses made of the supply in order to detect any active contamination which may occur at times and if such contamination be found to exist that immediate steps be taken to discover and remedy its cause.

In case such active contamination should be found present in the wells at the pumping station these wells should be abandoned and an additional supply of satisfactory sanitary quality obtained elsewhere as recommended in the previous report.

Respectfully submitted,
THEODORE HORTON,
Chief Engineer

ALBANY, N. Y., *September* 8, 1915

RESULTS OF WATER ANALYSES

Abbreviations used to describe odors of water: 0, none; 1, very faint; 2, faint; 3, distinct; 4, decided; 5, strong; 6, very strong; a, aromatic; d, disagreeable; e, earthy; f, fishy; g, grassy; m, musty; v, vegetable

Municipality	County	Source of sample	Date of collection	Physical				Chemical (Parts Per Million)											Bacteriological			
						Odor		Solids			Nitrogen as—						Hardness		Bacteria per c.c.; gelatin 20°; 48 hours	B. Coli Type + = present — = absent		
				Color	Turbidity	Cold	Hot	Total	Loss on ignition	Mineral residue	Free ammonia	Albuminoid ammonia	Nitrites	Nitrates	Oxygen consumed	Chlorine	Total	Alkalinity		10 c.c.	1 c.c.	1-10 c.c.
Ellicottville....	Cattaraugus...	Tap, public supply..........	12/16/12	Tr.	Cl.	....	....	46	6	40	.014	.022	.001	0.36	0.40	0.75	28.5	24.0	100	+	—	—
Ellicottville....	Cattaraugus...	Tap, public supply..........	1/27/13	Tr.	Cl.	....	....	39	....	....	.018	.032	.002	0.36	0.40	1.25	19.5	17.0	20	—	—	—
Ellicottville....	Cattaraugus...	Tap, public supply..........	2/24/13	Cl.	Tr.	....	....	137	....	....	.012	.032	Tr.	0.50	0.80	2.75	91.8	91.0	130	—	—	—
Ellicottville....	Cattaraugus...	Tap, public supply..........	4/ 7/13	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	220	—	—	—
Ellicottville....	Cattaraugus...	Tap, public supply..........	4/24/13	Tr.	Cl.	....	....	135	....	....	.008	.024	Tr.	0.50	0.20	2.00	85.7	83.0	....	....	....	....
Ellicottville....	Cattaraugus...	Tap, public supply..........	7/14/13	Tr.	Cl.	....	....	126	....	....	.004	.006	.001	0.34	0.20	2.50	94.2	93.0	....	+	+	—
Ellicottville....	Cattaraugus...	Tap, public supply..........	12/ 2/13	Tr.	Tr.	....	....	135	18	117	.012	.014	.002	0.40	0.60	2.25	111.4	85.0	30	—	+	—
Ellicottville....	Cattaraugus...	Reservoir..........	12/ 6/13	Tr.	5	....	....	66	17	49	.014	.034	.002	0.60	1.10	1.25	29.9	29.0	220	—	—	—
Ellicottville....	Cattaraugus...	Marsh spring..........	12/ 6/13	Tr.	Cl.	....	....	44	14	30	.014	.028	.002	0.20	0.80	0.75	26.0	22.0	130	+	—	—
Ellicottville....	Cattaraugus...	Pump station..........	12/ 6/13	Tr.	Cl.	....	....	119	18	101	.018	.016	.002	0.60	0.50	2.25	91.4	90.0	230	—	—	—
Ellicottville....	Cattaraugus...	Niles spring..........	12/ 6/13	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	50	+	—	—
Ellicottville....	Cattaraugus...	Tap, public supply..........	12/ 6/13	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	90	—	—	—
Ellicottville....	Cattaraugus...	Tap, public supply..........	12/ 6/13	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	20	+	—	—
Ellicottville....	Cattaraugus...	Tap, public supply..........	12/ 6/13	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	45	—	—	—
Ellicottville....	Cattaraugus...	Tap, public supply..........	4/17/14	Tr.	Cl.	1 v.	1 v.	51	12	39	.030	.030	.001	0.28	0.80	1.00	23.4	20.0	15	—	—	—
Ellicottville....	Cattaraugus...	Tap, public supply..........	2/17/15	Tr.	Cl.	1 v.	1 v.	109	6	103	.014	.004	.001	0.40	1.70	2.75	87.1	86.0	20	0+3—	0+3—	0+3—
Ellicottville....	Cattaraugus...	60-ft. wells..........	2/17/15	....	....	....	....	....	....	....	....	....	....	....	....	3.00	....	....	10	0+3—	0+3—	0+3—
Ellicottville....	Cattaraugus...	36-ft. wells..........	2/17/15	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	40	0+3—	0+3—	0+3—

ELMIRA

HERMANN M. BIGGS, M.D., *State Commissioner of Health:*

A reinspection of the public water supply of Elmira was made on February 11, 1915, by Dr. H. H. Crum, sanitary supervisor of District "R." A previous inspection of this supply was made by Prof. H. N. Ogden in 1908 in connection with an investigation of the sanitary condition of this city with special reference to its water supply. The report of Prof. Ogden will be found on page 725 of the twenty-ninth annual report of this Department. In 1909 a special investigation of the filtration plant was made by this Department, the report of which will be found on page 397 of the thirtieth annual report of the Department.

The public water supply of Elmira is derived from two sources, the Chemung river and Hoffman creek. The water from both sources is subjected to sterilization by hypochlorite of lime and filtration by means of mechanical filters. The detailed description of the filter plant and water works system in general remains practically the same as described in the earlier reports. The water works which were formerly owned by the Elmira Water, Light and Railroad Co., were purchased this year by the city.

The filtration plant consists of 21 units of gravity mechanical filters constructed by the New York Continental Jewel Filtration Co. The total capacity of these filters is approximately 7,000,000 gallons per 24 hours. The plant is operated at its full capacity for about 16 hours each day and the average daily water consumption is approximately 5,000,000 gallons. About three-quarters of the time the Chemung river is used as the source of raw water and the remainder of the time Hoffman creek is the source. Alum is used as a coagulant and at the time of the inspection was being added at the rate of 0.9 grains per gallon. Hypochlorite is added to the water before filtration as there are no facilities for applying it to the filtered water. The plant is in charge of an expert operator by whom daily analyses of the raw and filtered water are made.

The Chemung river above the water works intake has a watershed of approximately 2,000 square miles. Upon this area there are numerous villages and one or two cities. The total population upon this drainage area may be roughly estimated at 50,000, or 25 per square mile.

MUNICIPALITIES ABOVE ELMIRA ALONG CHEMUNG RIVER AND ITS TRIBUTARIES

	Distance above Elmira (Miles.)	*Population 1910 Census*	*Sewer System*
Big Flats	11	300	....
Corning	18	13,730	Public.
Painted Post	22	1,224	Private.
Addison	31	2,004	Private.
Bath	40	3,884	Private.
Canisteo	45	2,250	Private.
Hornell	50	13,617	Public.

It is evident from this table that at least 30,000 people are contributing sewage to the Chemung river above the water works of Elmira. The seriously contaminated condition of the Chemung river is consequently very apparent and this condition is further brought out by the results of analyses given in the appended table.

Hoffman creek has a drainage area of 4.6 square miles. The population upon this area is about 125, or 27 per square mile. While this supply is not so seriously contaminated by direct sewage discharge as in the case of the Chemung river there are numerous opportunities for direct contamination of the stream due to the comparatively large resident population upon the drainage area and the location of several houses very close to the creek.

Rules and regulations for the sanitary protection of the water supply of

Elmira were enacted by this Department in 1896 but very little, if any, attempt has been made by the local authorities to enforce such rules.

At the time of his inspection Dr. Crum collected samples of raw and filtered Chemung river water and later samples of raw and filtered Hoffman Creek water were also collected. The results of the analyses of these samples with others made in the past by the Division of Laboratories and Research will be found in the appended table.

The analyses extending back over the past four years show clearly the grossly contaminated condition of the unfiltered water, the total numbers of the bacteria being at all times very high and organisms of the B. coli type present in very small dilutions. The table, however, shows as a rule, a very satisfactory purification effected by the filtration plant. The total bacterial counts in the filtered water are usually low and organisms of the B. coli type are invariably absent in samples as large as 10 c. c.

Although the filtration plant was installed as far back as 1897 and the design is not quite in accordance with modern practice, the analytical results as discussed above show clearly that with careful operation the plant has been able to produce a very satisfactory effluent. In all cases the efficiency of the water filtration plant depends to a very large extent upon the care with which it is operated and the requirement for careful operation cannot be too strongly emphasized.

In view of the above facts the following conclusions may be drawn:

1. That both sources of raw water for the Elmira supply are seriously contaminated especially the Chemung river which receives direct sewage discharge from a large population.

2. That the filtration plant has been capable with proper methods of operation of producing a water of satisfactory sanitary and esthetic quality.

3. That the filter plant is, however, being operated nearly at its maximum capacity and its design is not quite in accordance with modern practice.

I would therefore recommend:

1. That the city authorities make plans at once for the installation of larger filter capacity in order to provide for proper treatment of the increasing amount of water consumed.

3. That the city continue to operate the plant with a high and constant degree of expert supervision.

3. That the city authorities consider the possibility of sterilizing the effluent of the filters instead of the water applied to the filters. If this is found practicable it might be well to substitute liquid chlorine for hypochlorite of lime.

Respectfully submitted,

THEODORE HORTON,
Chief Engineer

ALBANY, N. Y., *September* 3, 1915

RESULTS OF WATER ANALYSES

Abbreviations used to describe odors of water: 0, none; 1, very faint; 2, faint; 3, distinct; 4, decided; 5, strong; 6, very strong; a, aromatic; d, disagreeable; e, earthy; f, fishy; g, grassy; m, musty; v, vegetable

Municipality	County	Source of sample	Date of collection	Physical				Chemical (Parts Per Million)											Bacteriological			
						Odor		Solids			Nitrogen as—						Hardness			B. Coli Type + = present — = absent		
				Color	Turbidity	Cold	Hot	Total	Loss on ignition	Mineral residue	Free ammonia	Albuminoid ammonia	Nitrites	Nitrates	Oxygen consumed	Chlorine	Total	Alkalinity	Bacteria per c.c.; gelatin 20°; 48 hours	10 c.c.	1 c.c.	1-10 c.c.
Elmira	Chemung	Raw water	1/10/12	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	375	+	+	—
Elmira	Chemung	Filtered water	1/10/12	Tr.	Cl.	....	....	143	22	121	.050	.030	.001	0.80	0.70	5.37	90.0	65.0	2	—	—	—
Elmira	Chemung	Raw water	2/13/12	10	Tr.	....	....	175	40	135	.078	.060	.010	1.20	1.35	6.37	114.2	100.0	550	+	—	—
Elmira	Chemung	Filtered water	2/13/12	Tr.	Cl.	....	....	186	17	169	.078	.066	.001	0.90	0.77	6.37	117.2	94.0	20	—	—	—
Elmira	Chemung	Raw water	3/21/12	40	100	....	....	52	21	31	.016	.234	.002	0.26	15.2	1.25	18.2	13.0	25,000	+	+	+
Elmira	Chemung	Filtered water	3/21/12	5	Cl.	....	....	39	9	30	.022	.074	Tr.	0.36	2.90	1.75	19.5	4.0	20	—	—	—
Elmira	Chemung	Raw water	4/24/12	25	15	....	....	117	16	101	.020	.082	.002	0.68	3.20	3.00	67.1	47.0	4,900	+	+	+
Elmira	Chemung	Filtered water	4/24/12	Tr.	Cl.	....	....	103	14	89	.022	.048	.001	0.80	1.30	3.50	70.0	39.0	10	—	—	—
Elmira	Chemung	Raw water	11/26/12	25	5	....	....	....	....	....	.006	.162	.001	0.04	3.60	1.37	41.6	34.0	200	+	—	—
Elmira	Chemung	Filtered water	11/26/12	Tr.	Cl.	....	....	77	18	59	.008	.090	Tr.	0.02	1.80	1.87	44.3	32.0	10	—	—	—
Elmira	Chemung	Raw water	1/ 2/13	30	12	....	....	....	....	....	.020	.134	.001	0.20	2.80	2.25	51.4	29.0	500	+	+	—
Elmira	Chemung	Filtered water	1/ 2/13	5	Cl.	....	....	76	....	....	.032	.078	Tr.	0.20	1.30	2.25	51.4	21.0	15	—	—	—
Elmira	Chemung	Raw water	2/10/13	10	2	....	....	129	....	....	.030	.050	.001	0.90	2.50	4.50	82.9	60.0	22,000	+	—	—
Elmira	Chemung	Filtered water	2/10/13	Tr.	Cl.	....	....	123	....	....	.042	.042	Tr.	0.90	1.30	4.75	84.3	59.0	10	—	—	—
Elmira	Chemung	Raw water	3/24/13	10	20	....	....	96	....	....	.022	.096	.002	0.50	2.50	2.75	50.0	37.0	6,500	+	+	—
Elmira	Chemung	Filtered water	3/24/13	Tr.	Cl.	....	....	101	....	....	.048	.092	Tr.	0.46	1.30	3.25	51.4	29.0	20	—	—	—
Elmira	Chemung	Raw water	5/ 5/13	17	110	....	....	103	....	....	.016	.154	.001	0.50	3.40	1.25	28.6	19.0	....	+	+	+
Elmira	Chemung	Filtered water	5/ 5/13	Tr.	Cl.	....	....	67	....	....	.020	.062	Tr.	0.36	1.30	1.25	23.6	11.0	....	—	—	—
Elmira	Chemung	Raw water	6/26/13	8	10	....	....	169	....	....	.018	.100	.004	0.24	1.60	6.12	97.1	85.0	25,500	+	+	—
Elmira	Chemung	Filtered water	6/26/13	Tr.	Tr.	....	....	161	....	....	.024	.064	.001	0.20	1.20	6.25	98.6	78.0	250	—	—	—
Elmira	Chemung	Raw water	5/ 2/14	10	30	2 a.	3 a.	84	19	65	.018	.110	.001	0.36	3.30	1.50	26.0	15.0	....	......	......	......
Elmira	Chemung	Filtered water	5/ 2/14	Tr.	1	1 v.	1 v.	58	15	43	.014	.038	Tr.	0.36	1.70	1.75	23.4	11.0	....	—	—	—
Elmira	Chemung	Raw Chemung river water	2/11/15	5	2	1 v.	1 v.	93	15	78	.008	.016	.002	0.30	3.00	3.38	51.4	43.0	2,000	3+0—	3+0—	2+1—
Elmira	Chemung	Filtered Chemung river water	2/11/15	Tr.	Cl.	1 v.	1 v.	67	8	55	.016	.014	Tr.	0.36	2.05	4.13	52.9	30.0	20	0+3—	0+3—	0+3—
Elmira	Chemung	Filtered Chemung river water	2/11/15	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	10	0+3—	0+3—	0+3—
Elmira	Chemung	Raw Hoffman creek water	3/ 5/15	12	10	1 v.	1 v.	95	23	72	.006	.050	.001	0.40	3.40	1.75	29.9	25.0	350	3+0—	0+3—	0+3—
Elmira	Chemung	Filtered Hoffman creek water	3/ 5/15	Tr.	Cl.	1 v.	1 v.	68	10	58	.012	.012	.002	0.40	1.80	2.50	39.0	12.0	15	0+3—	0+3—	0+3—

FAIRPORT

HERMANN M. BIGGS, M.D., *State Commissioner of Health:*

An investigation of the water supply of the village of Fairport was made on October 6, 1915, by Mr. M. F. Sanborn, assistant engineer, who was assisted at the time of the inspection by Mr. W. H. Bobbin, president of the Municipal Commission; Mr. C. J. Sullivan, superintendent of the water and light plant; Dr. C. V. Patchin, sanitary supervisor, and Dr. C. E. White, health officer of the village of Fairport.

Fairport is an incorporated village in the town of Perinton and is located in the eastern part of Monroe county. It is about eight miles west of Rochester on Irondequoit creek. The New York Central and Hudson River Railroad and the New York State Railway pass through the village. The population at the time of the inspection was about 3,553.

The water supply is owned by the municipality and the water works were designed by Mr. W. F. Randall, civil engineer of Syracuse and were constructed under various contracts in the year 1893 under the supervision of Mr. Randall.

The water supply is obtained from four driven wells located in the lower eastern part of the village. The water from these wells is pumped at a nearby pumping station direct to the water mains and reservoir. Fire protection is provided in the village by the use of hydrants placed in various parts of the village. About 2,842 or 80 per cent. of the entire population are served by this water supply. Several of the hotels, industries and the railroad use the water from Lake Ontario on account of the hardness of the local supply. The average daily consumption amounts to about 180,600 gallons, which would correspond to a per capita consumption of about 64 gallons. For washing purposes most of the houses use rain water collected from the roofs and stored in large tanks or cisterns in the basements.

There are about 11 miles of water mains varying in size from 4 to 10 inches in diameter. The water is distributed by pumping and the average pressure throughout the village is about 85 pounds per square inch.

The greater portion of the village is sewered under the combined system and all the dry weather flow of sewage is collected and conveyed to a disposal plant located in the western part of the village. This disposal plant consists of settling tanks and a sludge bed.

The four wells are driven through about four feet of top soil of sand and gravel and then through shaly limestone. Three of the wells have total depths of about 75 feet and the other one has a depth of about 100 feet. The four wells are all located about 30 feet apart. The wells appeared to be properly protected from surface drainage. This however could not be verified, since none of the officials at present in charge were connected with the plant during its construction, and it could not be determined without excavating to the rock.

Adjacent to these wells is the pumping station, which is of brick and is 87′ x 56′ in plan. This station consists of a boiler room, pumping equipment and the municipal electric light plant, all of which come under the control of the municipal commission. The pumping equipment consists of three 150 horse power tubular boiler and one Gould triplex plunger pump 8¼″ x 10″ which is rated at 360 gallons per minute. This pump is operated by a 225 horse power engine which also operates one of the light generators. There is also a direct acting Blake duplex pump 12″ x 18½″ x 10½″ x 12″ in size. The operating force at the pumping station consists of a superintendent, two engineers and three firemen and the work of these men is charged up to both the lighting and water departments. The pumps are ordinarily operated from about 6 A. M. to 10:30 P. M.

The standpipe is of steel, 26 feet in diameter and 70 feet high, and is located on a hill in the southeastern part of the village. It has a capacity of about 300,000 gallons, which is equivalent to about two days' supply. The standpipe is cleaned out about every five years, while the water mains are flushed out four or five times a year.

There is a very small watershed tributary to the wells on the surface of the ground while the underground area from which the wells might draw water may be several square miles, due to their location in the valley and to their nearness to the main creek draining the valley and to the New York State Barge canal. The wells are about 400 feet from the Barge canal, the surface of which is about eight feet above the surface of the ground at the well. The main creek draining the valley is about 600 feet from the wells and at a slightly lower elevation. The water in the wells ordinarily is about 13 to 15 feet below the surface when the pumps are being operated.

There are three houses within a radius of 100 feet of the well, 30 houses within a 500-foot radius and 93 houses within a 1,000-foot radius. This would give a population of about 120 persons within the 500-foot radius and about 370 within the 1,000-foot radius.

A chicken house and yard containing about 20 chickens are located between the wells on the property belonging to the village. About 75 feet east of the wells a privy is located at which excreta can be seen draining over the ground, and about 100 feet east another privy was in the same condition. The street on which the wells are located is not sewered and most of the houses have no sanitary conveniences except privies located in the back yards. The sanitary conditions in the neighborhood were very bad and gave ample opportunity for polluted water draining from these privies to percolate through the ground and rock to the wells.

At the time of the inspection a sample of the water was obtained from a tap in the village and from a tap at the pumping station, and the analyses of these together with those made by the Division of Laboratories and Research in the years 1908 and 1909 will be found in the appended table.

From the results of these analyses it will be seen that the water is clear, practically colorless and odorless. The water is exceptionally hard, the greater part of the hardness being of a permanent character. The figures for nitrogen in its various forms are somewhat high for an uncontaminated well water. The figures for nitrates in particular are rather high and indicate a certain amount of organic contamination, oxidized, however, by passage through the soil. The oxygen consumed and chlorine are also high. While the high chlorine may be due in part to the location of the wells in rock of the salina limestone formation, there is also the strong possibility that a certain amount of this chlorine is derived from the various sources of contamination in the neighborhood. The number of bacteria are low, although bacteria of the B. coli type were found in 10 c. c. and in one of the 1 c. c. samples. The presence of bacteria of the B. coli type is evidence of active contamination by animal or human wastes.

As a result of this investigation and of the analyses, the following conclusions may be drawn:

1. That the wells from which the present water supply of Fairport is derived are, very unfortunately, located in the lower section of the village and in the neighborhood of numerous insanitary conditions which undoubtedly cause contamination of the ground water in the vicinity.
2. That, as is true of wells located in shale and limestone formation, there is the ever present probability of incompletely purified surface water reaching the wells through channels and crevices in the rock strata.
3. That the lack of proper sewage disposal in the neighborhood renders the danger of such contamination reaching the wells much more acute.
4. That the hardness of the water renders it unsuitable for use in laundry work and washing, although if the water was properly softened it could be used for all purposes and the use of the rain water could be abandoned.

In view of the above conclusions, I would make the following recommendations:

1. That the village authorities provide for a suitable tight sewer in the street passing by the wells and that all houses in the neighborhood be obliged to connect with the same.
2. That a liquid chlorine plant or some other suitable sterilization

apparatus be installed and that all water be treated with a sterilizing agent.

3. That the village arrange to have a study made of the advisability of installing a water softening and filtration plant.

Respectfully submitted,

THEODORE HORTON,
Chief Engineer

ALBANY, N. Y., *November* 15, 1915

REPORT OF WATER ANALYSIS FOR FAIRPORT

Source		Tap, outside Osborn hotel	Tap	Tap, at house near pump station	Tap, Dr. White's house
Collected on		3/31/08	3/3/09	10/6/15	10/6/15
Color		2	....	Trace	....
Odor, hot		....	....	1 v	....
Odor, cold		....	....	1 v	....
Turbidity		Clear	....	Clear	....
Solids, total		1,538	....	1,023	....
Loss on ignition		....	....	85	....
Mineral residue		....	....	938	....
Ammonia, free		.026	....	.026	....
Ammonia, albuminoid		.050	....	.018	....
Nitrites		.003	....	.003	....
Nitrates		0.36	....	0.70	....
Oxygen consumed		0.40	....	2.90	....
Chlorine		17.5	....	15.75	....
Hardness, total		1,107.5	....	757.0	....
Alkalinity		187.0	....	181.0	....
Bacteria per c.c		170	15	20	10
B. coli type	10 c.c.	—	—	2+1—	1+2—
	1 c.c.	—	+	0+3—	1+2—
	1/10 c.c.	—	—	0+3—	0+3—

Results are expressed in parts per million: + Present. — Absent.

Abbreviations used to describe odors of water: 0, none; 1, very faint; 2, faint; 3, distinct; 4, decided; 5, strong; 6, very strong; a, aromatic; d, disagreeable; e, earthy; f, fishy; g, grassy; m, musty; v, vegetable.

FARMINGDALE

HERMANN M. BIGGS, M.D., *State Commissioner of Health:*

An inspection was made of the public water supply of Farmingdale, L. I., by Mr. C. M. Baker, assistant engineer, on May 13, 1915.

The incorporated village of Farmingdale is located on the main line of the Long Island Railroad about 32 miles from New York city in the county of Nassau. The present population of the village is approximately 2,000.

The water supply is controlled and operated by the village. The water supply is derived from wells located along the railroad track in the eastern edge of the village, from which the water is pumped into storage tanks under air pressure, when it is distributed through the mains to the consumers. Fifty or sixty per cent. of the population are served with the water. The consumption averages approximately 160,000 gallons daily, which corresponds to a per capita rate of about 145 gallons per day. The pressure ranges from 50 to 65 pounds per square inch.

The three wells from which the supply is derived are provided with tile casings and 12-inch suction lines. They are 40 feet deep. The strata through which the wells pass and in the vicinity are composed of comparatively fine sand which is quite uniform in size. The water is pumped from the wells into storage tanks by two Dean pumps, one with a capacity of 500 gallons and

the other 400 gallons per minute. The suction lift on the pumps varies from 15 to 18 feet. There are four metal tanks, each with a capacity of 12,500 gallons, two of which are used for the storage of water and the other two for air pressure purposes. From the storage tanks the water is forced by the air pressure through about six miles of mains varying in size from 4 to 8 inches in diameter.

The density of population within a quarter of a mile of the wells is equivalent to 625 persons per square mile, and within one-half mile, 730 per square mile. Outside of this area and within the limits of probable area of influence of the wells the population is approximately 50 per square mile. The privy at the pumping station is located about 50 feet from one of the wells and is provided with a concrete vault, which although it appeared to be tight was in need of cleaning at the time of inspection. There was also a garbage dump located near the privy which was in an insanitary condition when the inspection was made. Aside from these insanitary conditions there appeared to be practically no other sources of pollution in the immediate vicinity of the wells, no other buildings being located within 400 or 500 feet of the plant.

No samples of the water were taken at the time of the inspection, but samples were later collected by Dr. J. F. Michels, health officer, and sent to the Division of Laboratories and Research for analysis. The results are as follows:

REPORT OF WATER ANALYSIS FOR FARMINGDALE

Source		Wells	Tap in village
Collected on		6/18/15	....
Color		Trace	....
Turbidity		Clear	....
Odor, cold		1 v.	....
Odor, hot		1 v.	....
Solids, total		53	....
Loss on ignition		12	....
Mineral residue		41	....
Ammonia, free		.002	....
Ammonia, albuminoid		.004	....
Nitrites		.001	....
Nitrates		1.20	....
Oxygen consumed		0.60	....
Chlorine		7.25	....
Hardness, total		27.30	....
Alkalinity		3.00	....
Iron		0.15	....
Bacteria per c. c.		4,000	250
B. Coli type	10 c. c.	0+3—	0+3—
	1 c. c.	0+3—	0+3—
	1/10 c. c.	0+3—	0+3—

Results are expressed in parts per million. + Present. — Absent.
Abbreviations used to describe odors of water: 0, none; 1, very faint; 2, faint; 3, distinct; 4, decided; 5, strong; 6, very strong; a, aromatic; d, disagreeable; e, earthy; f, fishy; g, grassy; m, musty; v, vegetable.

The results of the analyses indicate that the physical character of the water is satisfactory in regard to color, turbidity, odor, etc. Only a small amount of organic matter is present in the form of free and albuminoid ammonia and nitrites. Nitrates, however, are somewhat above the normal and chlorine is approximately double the normal for this locality. The bacterial content is high, but this is doubtless due to multiplication in transit, since the samples were not iced. The B. coli type, however, was not found present in 30 c. c. volumes. The high nitrates and chlorine indicate that pollution is finding its way into the ground water which supplies the wells, but the low figures for free and albuminoid ammonia and nitrites, also the absence of the colon type, indicate that the water had become well purified in its passage through the soil.

The existence of high nitrates and chlorine in the supply should, however, be regarded with some suspicion, since it is uncertain whether the purifying effect of the soil will continue to effectively remove the pollution from the water before it reaches the well. In fact, it is quite possible that at certain

seasons of the year when the ground water flow is at a maximum or at times when there is a heavy draft on the water, the supply may become actively contaminated. Since there are no houses in the immediate vicinity of the plant, it is apparent that the greatest menace to the supply is the insanitary condition in the vicinity of the privy at the pumping station, and it is, therefore, probable that if this condition were corrected the possibility of contamination of the supply would become largely if not wholly eliminated.

As a result of this investigation it is apparent that the public water supply of Farmingdale was not actively contaminated at the time of the inspection. It is possible, however, that, due to the insanitary conditions in the immediate vicinity of the plant and also the dense population within one-quarter mile of the plant, active contamination may at times occur.

I therefore beg to submit the following recommendations:

1. That the garbage be removed from the water works premises at all times and not allowed to accumulate on the ground in the vicinity of the plant and that the privy be cleaned and put in a sanitary condition.

2. That, where they are not already so equipped, all privies be provided with watertight containers and all cesspools made impervious within a radius of 500 feet of the wells and that the contents from them be disposed of in a remote place in a satisfactory and sanitary manner.

3. That analyses of the water be made occasionally during the year to detect any active contamination which may occur in the future.

4. That should such active contamination at any time occur steps be taken immediately

(a) to determine and remove sources of such pollution if possible, or

(b) purify the supply or sterilize it with liquid chlorine.

(c) Should the above improvements fail to render the supply satisfactory, new wells or other supply be developed which shall be free from any source of contamination.

Respectfully submitted,

THEODORE HORTON,
Chief Engineer

ALBANY, N. Y., *July* 19, 1915

FLORIDA

HERMANN M. BIGGS, M.D., *State Commissioner of Health:*

A reinspection of the public water supply of Florida was made on August 10, 1915, by Dr. C. W. Berry, sanitary supervisor of District "N". A previous inspection of this supply was made by the Engineering Division in 1909, the report of which will be found on page 302 of the thirtieth annual report of this Department.

The water supply of this village is obtained from Glenmere lake, about one and one-half miles east of the village. The intake extends about 24 feet into the lake and is about 500 feet from the outlet of the lake. The water supply system in general remains practically the same as described in detail in the earlier report. The water works are owned and operated by the Florida Water Works Company.

Glenmere lake is an irregularly shaped body of water about 1.3 miles long and .6 of a mile wide at its widest part. The watershed tributary to this lake is approximately two square miles in area. The total population is about 50, or 25 per square mile. At the time of the earlier inspection this lake was used by camping and picnic parties for boating and bathing. Since this earlier report, however, the land surrounding the lake has been acquired by Mr. Robert Goelet who no longer allows fishing, bathing or picnic parties to frequent the vicinity. Some bathing, however, may be done by individuals. A large dog kennel has been constructed near the upper end of the lake near Mr. Goelet's residence. Some contamination by surface wash from the highway which runs along the east shore may also occur.

In the earlier report the probability of contamination of the water by

bathing in the lake and vicinity of the intake was clearly pointed out and the following recommendations were called to the attention of the Water Works Company.

1. A complete inspection of the watershed of Glenmere lake should be made, and measures taken to remove all sources of pollution and to prevent their recurrence in the future.

2. It is imperative that measures should be taken to prevent bathing and to restrict boating and the occupancy of the shore by pleasure seekers in the vicinity of the intake.

3. In case they experience any difficulty in removing sources of pollution or otherwise find it impracticable to protect their supply, to consider the question of application to this Department for the enactment of rules and regulations in accordance with Sections 70 and 71 of the Public Health Law.

From the report of Dr. Berry it appears that the opportunities for contamination of the lake by bathing have been moderately decreased owing to the ownership of the shore of the lake by a private individual.

At the time of his inspection Dr. Berry collected samples of water from the lake and from a tap on the distribution main and results of the analyses of these samples together with others made in the past by the Division of Laboratories and Research will be found in the appended table.

These analyses show a water moderately colored, at times slightly turbid and very soft. The figures for nitrogen in its various forms are moderately high, indicating the presence of organic matter, probably largely of vegetable origin. The bacterial counts are usually low or moderate although fecal organisms of the B. coli type are occasionally present. The samples collected by Dr. Berry were two days in reaching the laboratory and this fact may account for the unsatisfactory bacterial results in the case of these samples.

In view of the above facts the following conclusions may be drawn:

1. That the opportunities for contamination of Glenmere lake from which the water supply of Flordia is obtained, are somewhat less than at the time of the previous inspection due to the control of the shores of the lake by a private individual.

2. That as is true of all surface supplies, the lake is open to accidental, incidental or wilful contamination by chance visitors upon or in the vicinity of the lake.

I would, therefore, recommend:

1. That the Florida Water Company maintain constant supervision over the lake and its watershed in order to detect and prevent any permanent sources of contamination.

2. That the water company install and operate suitable apparatus for the sterilization of the supply with liquid chlorine in order to minimize the danger from intermittent contamination.

Respectfully submitted,

THEODORE HORTON,

Chief Engineer

ALBANY, N. Y., *November* 15, 1915

RESULTS OF WATER ANALYSES

Abbreviations used to describe odors of water: 0, none; 1, very faint; 2, faint; 3, distinct; 4, decided; 5, strong; 6, very strong; a, aromatic, d, disagreeable; e, earthy; f, fishy; g, grassy; m, musty; v, vegetable

Municipality	County	Source of supply	Date of collection	PHYSICAL				CHEMICAL (PARTS PER MILLION)											BACTERIOLOGICAL			
						ODOR		SOLIDS			NITROGEN AS—						HARDNESS			B. COLI TYPE + = PRESENT — = ABSENT		
				Color	Turbidity	Cold	Hot	Total	Loss on ignition	Mineral residue	Free ammonia	Albuminoid ammonia	Nitrites	Nitrates	Oxygen consumed	Chlorine	Total	Alkalinity	Bacteria per c.c.; gelatin 20°, 48 hours	10 c.c.	1 c.c.	1-10 c.c.
Florida	Orange	Tap, public supply	1/12/11	10	10	....	....	35	14	21	.026	.192	.002	Tr.	4.30	2.00	15.6	12.0	70	+	—	—
Florida	Orange	Tap, public supply	5/18/11	15	Tr.	....	....	30	5	25	.018	.218	Tr.	0.10	2.40	1.25	14.3	10.0	650	+	—	—
Florida	Orange	Tap, public supply	10/26/11	5	Cl.	....	....	53	18	35	.018	.146	.001	0.04	1.90	2.00	20.8	15.0	90	+	+	—
Florida	Orange	Tap, public supply	1/25/12	15	Cl.	....	....	49	10	39	.034	.156	Tr.	0.04	2.60	1.50	18.2	14.0	120	—	—	—
Florida	Orange	Tap, public supply	4/ 4/12	15	Cl.	....	....	36	5	31	.010	.078	Tr.	0.04	2.30	1.50	16.9	13.0	110	—	—	—
Florida	Orange	Tap, public supply	1/29/13	15	Tr.	....	....	35	....	....	.012	.112	Tr.	0.06	3.70	1.50	15.6	11.0	20	—	—	—
Florida	Orange	Tap, public supply	3/12/13	5	Cl.	....	....	48	....	....	.010	.110	Tr.	0.04	3.00	1.50	9.5	9.0	60	—	—	—
Florida	Orange	Tap, public supply	8/10/15	10	1	2 v.	2 v.	45	30	15	.012	.110	Tr.	0.16	3.40	1.75	14.3	4.0	*12,000	3+0—	3+0—	3+0—
Florida	Orange	Lake, near intake	8/10/15	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	*4,000	3+0—	1+2—	0+3—

* Two days in transit.

FOREST LAWN

HERMANN M. BIGGS, M.D., *State Commissioner of Health:*

An investigation of the water supply of the village of Forest Lawn was made on October 6, 1915, by Mr. M. F. Sanborn, assistant engineer, who was assisted at the time of the inspection by Mr. Frank Brower, manager of the water company, and Dr. C. V. Patchin, sanitary supervisor.

Forest Lawn is an unincorporated village and is occupied as a summer resort. It is located on the shore of Lake Ontario in the town of Webster in the northeastern part of Monroe county. It is about eight miles northeast of Rochester and the N. Y. C. & H. R. R. passes through the village. The population during the summer months is about 200, while during the winter the cottages are all closed and no one lives in the village.

The public water supply is owned by the Forest Lawn Water Works Company. The water works were designed and constructed by the company in 1901.

The water is obtained from several springs on the shore of the lake in the western part of the village. The water is conveyed from these springs to a small receiving tank or pump well from which it is pumped to a tank situated on a hill adjacent to the springs. No fire protection is provided in the village and there is about one-half mile of water mains from 1 to 2 inches in size.

About one-half the population is served by this water supply. No figures on the daily consumption could be obtained since there was no ready method of obtaining such. The consumption might run as high as 100 gallons per capita or 10,000 gallons per day during week ends while the rest of the week the consumption would be considerably less. There are about 60 houses in the village of which 30 are connected with the water supply and none of these services are metered. The average pressure in the village is about 40 pounds per square inch.

There is no sewer system in the village or method of sewage or excreta disposal except privies, septic tanks and cesspools.

The springs are situated on the face of the bluff at the shore of the lake, and the water issues at the junction of the rock with the fine sand which forms the soil of that district. The soil is fine red sand overlying Medina sandstone and shale. There are eight or nine springs consisting chiefly of shallow recesses which are made by placing a small amount of clay in front of each spring. Pipes convey the water from each spring to the pump well These springs are not protected in any manner, and after each storm they become filled with sand and have to be cleaned out in order that water may be obtained.

The pump well is about 6 by 8 feet in plan and 6 feet deep, and has a capacity of about 21,000 gallons. The pumping station which is constructed of wood, is located immediately above the pump well and is about 7 by 10 feet in plan. The pumping equipment consists of one Gould triplex plunger pump, having 2-inch diameters and 3-inch stroke. The pump is driven by a 1-horse power electric motor, operated automatically by a float device.

The tank which is located in the western part of the village is constructed of wood and is 12 feet in diameter and about 16 feet high. The base of this tank is about 18 feet above the ground and the tank has a capacity of about 13,600 gallons which is equivalent to about two-thirds of the maximum estimated daily capacity. This tank is cleaned out every fall when the water is shut off for the year. The mains are also flushed out at the same time.

The springs are located in a slight depression and immediately above some of them is located a drainpipe which drains several hundred feet of the railroad track and neighboring territory. There are two dwellings situated about 150 feet from the springs and about 30 feet higher in elevation. These buildings each have cesspools and privies and the natural drainage from them would be toward the springs. These cesspools and privies appeared to be in good condition and it is very doubtful if any active contamination

region. The total bacterial counts are high and fecal organisms of the B. coli type are frequently present in inoculations as small as 1 c. c. indicating, therefore, the presence of active contamination of animal or human origin.

In view of the above facts the following conclusions may be drawn:

1. That the village authorities of Frankfort have not carried out the previous recommendations of this Department nor have they fulfilled the requirement of the Conservation Commission for the enactment of rules and regulations for the protection of the Moyer creek supply.

2. That the water supplies derived from both Money Gulf creek and Moyer creek are open to serious contamination at times of rainfall by surface wash from highways, from manure piles, barnyards and in some instances from privies.

3. That both supplies are open to accidental or wilful contamination incidental to populated watersheds.

I would, therefore, recommend:

1. That the village authorities take immediate steps to remove and abate all sources of direct contamination upon the watersheds tributary to both sources of water supply.

2. That the village authorities make application to this Department for the enactment of rules and regulations for the sanitary protection of the water supplies derived from both Money Gulf creek and Moyer creek.

3. That in order to avoid all danger from chance contamination of the streams, the village install and operate suitable apparatus for sterilization of the supply with liquid chlorine.

Respectfully submitted,

THEODORE HORTON,
Chief Engineer

ALBANY, N. Y., *December* 4, 1915

RESULTS OF WATER ANALYSES

Abbreviations used to describe odors of water: 0, none; 1, very faint; 2, faint; 3, distinct; 4, decided; 5, strong; 6, very strong; a, aromatic; d, disagreeable; e, earthy; f, fishy; g, grassy; m, musty; v, vegetable

Municipality	County	Source of sample	Date of collection	Physical				Chemical (Parts per Million)												Bacteriological			
						Odor		Solids			Nitrogen as—						Hardness			B. Coli Type (+ = present, — = absent)		
				Color	Turbidity	Cold	Hot	Total	Loss on ignition	Mineral residue	Free ammonia	Albuminoid ammonia	Nitrites	Nitrates	Oxygen consumed	Chlorine	Total	Alkalinity	Bacteria per c.c.; gelatin 20°, 48 hours	10 c.c.	1 c.c.	1-10 c.c.
Frankfort	Herkimer	Tap, public supply	2/17/11	5	3	....	....	109	13	96	.012	.042	.003	Tr.	1.70	1.25	91	88	130	—	—	—
Frankfort	Herkimer	Tap, public supply	4/ 8/11	10	10	....	....	86	34	52	.020	.108	.001	0.30	2.70	1.50	47	46	1,100	+	+	—
Frankfort	Herkimer	Tap, public supply	5/25/11	10	2	....	....	146	11	135	.014	.092	.002	0.02	2.20	1.25	120	102	7,000	—	—	—
Frankfort	Herkimer	Tap, public supply	7/ 8/11	10	Tr.	....	....	160	24	136	.042	.068	.001	0.10	3.50	0.50	120	112	100	+	—	—
Frankfort	Herkimer	Tap, public supply	9/ 7/11	5	10	....	....	199	15	184	.008	.106	.001	0.04	1.60	1.75	126	124	200	+	+	—
Frankfort	Herkimer	Tap, public supply	10/13/11	10	3	....	....	160	31	129	.020	.086	.001	0.04	2.80	1.00	120	94	100	+	+	—
Frankfort	Herkimer	Tap, public supply	11/25/11	20	5	....	....	108	20	88	.014	.100	.001	0.06	2.85	1.50	73	70	100	+	—	—
Frankfort	Herkimer	Tap, public supply	12/20/11	15	5	....	....	124	23	101	.008	.072	.001	0.14	2.33	1.50	60	54	325	+	+	—
Frankfort	Herkimer	Tap, public supply	2/ 3/12	Tr.	Cl.	....	....	139	23	116	.010	.032	Tr.	0.30	0.90	1.50	106	97	30	+	+	—
Frankfort	Herkimer	Tap, public supply	4/29/12	15	15	....	....	68	19	56	.008	.064	.001	0.14	1.10	0.50	35	29	300	+	—	—
Frankfort	Herkimer	Tap, public supply	6/20/12	2	Tr.	....	....	140	22	118	.012	.038	.001	0.10	2.30	1.37	114	109	40	+	—	—
Frankfort	Herkimer	Tap, public supply	9/12/12	6	2	....	....	200	21	179	.008	.042	Tr.	0.10	1.60	1.75	143	132	170	+	—	—
Frankfort	Herkimer	Tap, public supply	10/11/12	15	25	....	....	168	14	154	.002	.094	.001	0.50	5.00	1.00	97	90	140	+	—	—
Frankfort	Herkimer	Tap, public supply	11/30/12	15	Tr.	....	....	112	21	91	.006	.064	.001	1.10	2.70	1.00	74	71	130	—	—	—
Frankfort	Herkimer	Tap, public supply	1/16/13	20	3	....	....	90	....	....	.008	.070	Tr.	0.16	2.70	1.00	53	48	1,500	+	+	+
Frankfort	Herkimer	Tap, public supply	2/20/13	5	Tr.	....	....	113	....	....	.022	.058	Tr.	0.24	1.00	1.75	83	82	60	—	—	—
Frankfort	Herkimer	Tap, public supply	3/27/13	15	100	....	....	98	....	....	.022	.188	.002	0.16	5.20	0.75	47	37	9,000	+	+	—
Frankfort	Herkimer	Tap, public supply	5/18/13	12	10	....	....	128	....	....	.010	.072	.001	0.04	2.10	1.25	84	76	1,000	+	—	—
Frankfort	Herkimer	Tap, public supply	6/12/13	10	2	....	....	125	....	....	.010	.048	Tr.	0.04	2.20	1.00	91	91	60	—	—	—
Frankfort	Herkimer	Tap, public supply	5/20/14	18	7	2 a.	2 a.	119	29	90	.006	.074	.001	0.08	3.00	0.50	64	62	110	+	+	—
Frankfort	Herkimer	Tap, public supply	8/18/15	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	180	1+2—	0+3—	0+3—
Frankfort	Herkimer	Reservoir	8/18/15	5	3	1 v.	1 v.	159	9	150	.024	.096	.001	.060	5.10	1.00	126	114	250	3+0—	3+0—	0+3—

FRANKLIN

HERMANN M. BIGGS, M.D., *State Commissioner of Health:*

An investigation of the public water supply of the village of Franklin was made on September 22, 1915, by Mr. C. M. Baker, assistant engineer, accompanied by Dr. C. C. Duryee, sanitary supervisor.

Franklin is an incorporated village of about 475 persons located in the town of Franklin, Delaware county. It is 5 miles from the village of Otego on the Delaware and Hudson railroad and about the same distance from Franklin station on the New York, Ontario and Western railroad. A small stream, known as Ouleout creek, passes through the village. There is a private sewer system which accommodates about 100 people and discharges into the creek without treatment. The rest of the sewage is cared for by cesspools and privies.

The water supply is owned by the village and is derived from springs located on the hill about 1¼ miles northwest of the village and also from an auxiliary supply the source of which is a spring or collecting gallery near the creek about ½ mile northeast of the village. From the main springs the water is conducted by gravity to a storage reservoir on the opposite side of the valley, whence it is distributed by gravity to the consumers. From the auxiliary supply it is necessary to pump the water to the reservoir. Approximately 90 per cent. of the population is served by the water. There is a total of 125 service taps, all of which are metered. The water consumption averages about 30,000 gallons daily, or 63 gallons per capita. The pressure at the village is 90 pounds per square inch.

The original water system consisted of a driven well 300 feet deep which was constructed in 1889 near the storage reservoir. This supply was insufficient to meet the demands of the village and it was also found expensive to pump the water from the well into the reservoir. The original supply was therefore abandoned and the present supply developed. The main source of supply for the present system was developed in 1894 and the auxiliary supply in 1913.

The reservoir is constructed of concrete and has a capacity of 224,000 gallons. It is covered and is divided into 2 compartments to facilitate cleaning. The water mains consist of about 3 miles of pipe ranging in size from 3 to 8 inches in diameter.

The springs from which the greater part of the water for the main supply is obtained are located on the upper side of the road leading from the village. The water is collected in a central well constructed of 24-inch tile by means of a collecting tile extending from it and also by direct infiltration. From this well the water is conveyed through a tile pipe by gravity to a concrete collecting reservoir about 100 feet distant. The reservoir and springs are located near a farm, the reservoir being about 20 feet distant from the house. The source of the springs, however, is located at a higher elevation than the barnyard or the house. The village owns about 2 acres of land in the vicinity of the springs which is enclosed by a fence, but the fence was down in many places and in need of repair at the time of the inspection. A second spring is located in a small ravine below the road. About 200 feet above this spring is a pigpen and barnyard. Although there is no direct surface drainage from them toward the spring, the ground water from which the spring derives its supply is probably contaminated from these sources. A third spring located just below the second derives its supply directly from the bottom of another ravine which receives drainage at times from pasture land. This spring, however, was not in use at the time of the inspection and the engineer was informed that its use was to be entirely discontinued. It is, however, still connected with the supply.

The auxiliary supply consists of a collecting gallery located at the base of a hill near Ouleout creek. From this gallery the water flows into a small reservoir from which it is pumped into the storage reservoir. The pumping equipment consists of a 6 h. p. gasoline engine and plunger pump with a

capacity of about 40 gallons per minute. At times of high water this collecting gallery and reservoir are doubtless flooded, but at times of low water, when this auxiliary spring would be used, the source of supply is probably entirely ground water. The nearest buildings are those of a farm and are about 1,000 or 1,200 feet above the springs. The contour of the land is such, however, that there is no direct surface drainage from these buildings to the supply. There is no fence to protect this supply from live stock which may be in the vicinity and although the collecting gallery is surrounded by meadow land it is possible that it is at times used as a pasture.

Samples of water were collected from the various supplies and sent to the Division of Laboratories and Research for analyses, the results of which are given in the appended table.

The results of the analyses of water collected from a tap in the village, the source of which was the springs northwest of the village, indicate the presence of considerable organic pollution, as is shown by the figures for free and albuminoid ammonia and nitrates. The chlorine content was also above normal for this locality. Although the bacterial count was moderate, the B. coli type was found present in all 3 of the 10 and 1 c. c. inoculations. Analyses of the sample collected from the group of springs above the road which constitute one source of supply for the tap water showed a moderate bacterial count with the B. coli type present in all 3 of the 10 c. c. inoculations. Analyses of water from the spring below the road, which constitutes the other source of supply for tap water, showed a very high bacterial count, with the B. coli type present in all 3 of the 10 c. c. inoculations and 2 of the 1 c. c. inoculations. These results indicate that the larger amount of pollution present in the tap water is derived from the latter spring. This pollution is doubtless due to the insanitary conditions above this spring which have been previously described. The presence of colon bacilli in the springs above the road is probably due to contamination by fowls and domestic animals in this vicinity, since the fence surrounding them offers little or no protection from this source of pollution.

The analyses of the sample collected from the auxiliary supply also show the presence of considerable organic pollution, as indicated by the figures for free and albuminoid ammonia and nitrates. The bacterial count was rather high and the B. coli type was present in all the 10 and 1 c. c. inoculations. This pollution is possibly due to surface wash finding its way into the collecting gallery.

As a result of this investigation, the following conclusions may be drawn:

1. That the first group of springs above the road northeast of the village are inadequately protected by fences and drainage ditches and that pollution thus finds its way into the supply is indicated by the results of analyses which show the presence of active contamination in the water at the time of the inspection.

2. That the second spring located below the road is also inadequately protected by fences and drainage ditches and in addition is subject to pollution due to the insanitary condition described in the body of the report. The analyses of water from this spring show the presence of considerable active contamination at the time of the inspection.

3. That the third spring, which is said to have been abandoned and is subject to pollution due to surface wash from pasture land, is still connected with the supply, although the valve controlling it was closed at the time of the inspection.

4. That suitable fences and drainage ditches are not provided for protecting the auxiliary supply, and that the analyses show the presence of active contamination at the time of the inspection.

In view of the above, I beg to offer the following recommendations to be acted upon by the village authorities:

1. That suitable fences be constructed about all the springs or sources of supply to keep domestic animals and fowls from their vicinity, and that adequate drainage ditches be constructed to divert surface wash.

2. That the insanitary condition above the second spring be eliminated or the spring abandoned as a source of supply.

3. That the connection which still exists between the third or abandoned spring and the mains be removed.

4. That no water be pumped from the auxiliary supply at such times as its quality may be affected by the elevation of the water in the creek, a condition which may occur during or immediately following high water.

5. That analyses of the water be made occasionally during the year and careful supervision of the supply maintained at all times to detect and prevent as far as possible the occurrence of any active contamination of the various springs tributary to the supply.

Respectfully submitted,

THEODORE HORTON,
Chief Engineer

ALBANY, N. Y., *December* 2, 1915

REPORT OF WATER ANALYSIS FOR FRANKLIN

Source		Tap in village	Springs above road	Springs above road	Auxiliary supply
Collected on		10/7/15	10/7/15	10/7/15	10/7/15
Color		Trace	....	....	Trace
Odor, hot		1 v.	....	....	1 v.
Odor, cold		1 v.	....	....	1 v.
Turbidity		Clear	....	....	Clear
Solids, total		66	....	....	59
Loss on ignition		12	....	....	9
Mineral residue		54	....	....	50
Ammonia, free		.028	....	....	.012
Ammonia, albuminoid		.012	....	....	.026
Nitrites		.001	....	....	.001
Nitrates		0.80	....	....	0.80
Oxygen consumed		1.90	....	....	1.30
Chlorine		2.00	....	....	2.00
Hardness, total		32.50	....	....	31.20
Alkalinity		14.00	....	....	23.00
Bacteria per c.c.		150	100	6,200	375
B. coli type	10 c.c.	3+0—	3+0—	3+0—	3+0—
	1 c.c.	3+0—	0+3—	2+1—	3+0—
	1/10 c.c.	0+3—	0+3—	0+3—	0+3—

Results are expressed in parts per million. + Present. — Absent.

Abbreviations used to describe odors of water: 0, none; 1, very faint; 2, faint; 3, distinct; 4, decided; 5, strong; 6, very strong; a, aromatic; d, disagreeable; e, earthy; f, fishy; g, grassy; m, musty; v, vegetable.

NOTE.— Samples were two days in transit.

FREDONIA

HERMANN M. BIGGS, M. D., *State Commissioner of Health:*

An investigation of the public water supply of Fredonia was made by Mr. C. M. Baker, assistant engineer, on June 29 and 30, and July 1, 1915.

Rules and regulations for the sanitary protection of this water supply were enacted by this Department in 1885.

An inspection was made of this supply in 1910, and since that time orders have been issued requesting inspections of the watershed and the transmittal each year of reports thereon to the Department. These orders, however, have not been complied with by the village authorities.

The incorporated village of Fredonia is located in Chautauqua county, about four miles south of the city of Dunkirk. It is reached either by the Dunkirk, Allegany Valley and Pittsburg railroad or by the Buffalo and Lake

Erie Electric road. The present population of the village is approximately 6,000.

The water supply is derived from the west branch of the Canadaway creek, the water being collected in impounding reservoirs located about four miles south of the village, whence it is delivered by gravity to the village system. Practically the entire population is served by the system. There is a total of some 1,400 service taps only two of which are metered. No method is provided for measuring the amount of water used and consequently no definite data could be obtained regarding the water consumption. The pressure of the village is approximately 90 pounds per square inch. The water works are owned and controlled by the municipality.

There are two impounding reservoirs, the upper one with a capacity of approximately 90 million gallons and the lower with a capacity of about 11 million gallons. A bypass is provided so that the stream may be diverted past the lower reservoir at times of heavy rainfall. The intake, located in the lower reservoir, consists of a stone crib provided with suitable gates and valves through which the water is delivered into a 12-inch main leading to the city. There are about twenty-five miles of water mains ranging in size from 2 to 12 inches in diameter. The majority of the mains in the village, however, are of 4 and 6-inch pipe.

The watershed is about four and one-half square miles in area and the slopes are in general quite steep. The distance from the upper boundary of the watershed to the reservoir is about three and one-half miles. Considerable of the area is wooded, especially in the immediate vicinity of the reservoir. The village owns the land adjacent to the reservoir and for some distance back from the water's edge. Most of the land adjacent to the streams above the reservoirs is used as pasture land, and it is estimated that approximately 300 head of stock have access to the stream. There are about 32 houses on the watershed with a population of about 150, corresponding to a density of about 33 people per square mile. No violation of the water rules was observed. The most serious condition from which it seems possible that the supply may become contaminated is the location of a cottage recently constructed near the upper end of the upper reservoir. This cottage is located on the brow of a hill so that the drainage from it finds its way directly to the stream below. The distance from the cottage to the stream, however, is 400 or 500 feet. As yet no privy has been provided but the engineer was informed that one is soon to be constructed. It is evident that in view of the close proximity of these premises to the reservoir, a tight removable container should be provided for the privy. The shores of the reservoirs are patroled daily by an attendant who looks after the supply. No regular inspection, however, is made of the watershed, although required by general orders issued by this Department in 1912. It is stated that during the construction of a highway near the reservoir, many of the laborers visited the reservoir and bathed and washed clothing therein.

Samples of water were collected at three different taps in the village and sent to the Division of Laboratories and Research for analyses, the results of which together with the results of previous analyses are recorded in the appended table.

It is apparent from the results of the analyses that the water is in general somewhat unsatisfactory in appearance because of the high color which ranges from 5 to 25 and of the turbidity which ranges from 3 to 160. As would be expected in the case of a water supply subject to surface wash from pasture lands the figures for free and albuminoid ammonia are comparatively high due to the presence of both vegetable and animal organic matter. The amount of oxidized nitrogen in the form of nitrates is moderate although the chlorine content is above the normal for this region. The bacterial content ranges from 45 to 2,500 and the B. coli type were found present in 91 per cent. of the 10 c. c. samples, 68 per cent. of the 1 c. c. samples and 23 per cent. of the 1/10 c. c. samples.

The presence of organic matter, the high bacterial content and the presence of B. coli is probably largely due to the stock which have access to the stream. Although it is not definitely established that such contamination

causes specific infectious disease, it seems probable that it may cause minor intestinal ailments, especially amongst invalids and others of low resistance. Although the conditions of the watershed appear to be quite satisfactory as far as permanent sources of contamination of human origin are concerned, it must not be overlooked that such a supply is always liable to accidental, incidental or wilful pollution by chance visitors upon the watershed and in fact specific instance of such pollution is not lacking.

As a result of this investigation, I would draw the following conclusions:

1. That, although the watershed of the water supply of Fredonia is practically free from permanent source of direct contamination of human origin, there is opportunity for indirect contamination from the resident population upon the watershed and the direct contamination of an accidental, incidental or wilful nature due to transient visitors passing over or engaged in work upon the watershed.

2. That the supply is open to contamination of animal origin from surface wash from pasture lands from cattle wading in the streams tributary to the reservoir and also from highway drainage.

3. That, although the reservoir and its immediate vicinity are inspected at frequent intervals, the remainder of the watershed is not sufficiently patroled and inspected nor have annual reports been submitted to this Department as required.

4. That, in view of the early date at which the rules and regulations for the protection of the supply were drafted, the provisions and restrictions embodied therein are not in accordance with the best modern practice.

I would therefore recommend:

1. That in order to protect the supply from the dangers of chance contamination and possible infection of human origin the village install suitable apparatus for the continuous sterilization of the water supply with liquid chlorine.

2. That the intake at the lower reservoir be more adequately protected from surface wash and suitable means provided to eliminate as far as practicable the turbidity present in the water.

3. That regular inspections be made at frequent intervals of the watershed in order that all violations of the water rules may be detected and corrected as soon as possible and that any case of typhoid fever or other suspicious illness may be reported at once to the health officer for diagnosis and proper isolation in case of communicable disease.

4. That the village authorities apply to this Department for a revision of the rules and regulations protecting the water supply from contamination.

Respectfully submitted,

THEODORE HORTON,

Chief Engineer

ALBANY, N. Y., *August* 6, 1915

RESULTS OF WATER ANALYSES

Abbreviations used to describe odors of water: 0, none; 1, very faint; 2, faint; 3, distinct; 4, decided; 5, strong; 6, very strong; a, aromatic d, disagreeable; e, earthy; f, fishy; g, grassy; m, musty; v, vegetable

Municipality	County	Source of sample	Date of collection	Physical				Chemical (Parts Per Million)											Bacteriological			
						Odor		Solids			Nitrogen as—						Hardness			B. Coli Type + = present − = absent		
				Color	Turbidity	Cold	Hot	Total	Loss on ignition	Mineral residue	Free ammonia	Albuminoid ammonia	Nitrites	Nitrates	Oxygen consumed	Chlorine	Total	Alkalinity	Bacteria per c.c.; gelatin 20°, 48 hours	10 c.c.	1 c.c.	1-10 c.c.
Fredonia	Chautauqua	Tap, public supply	3/23/10	5	25	....	....	104	28	76	.036	.168	.001	0.30	4.60	2.00	40.3	23.0	8,600	+	+	−
Fredonia	Chautauqua	Tap, public supply	5/24/10	15	80	....	....	113	30	83	.014	.104	.001	0.10	5.00	1.25	81.4	78.0	210	+	+	−
Fredonia	Chautauqua	Tap, public supply	10/10/10	15	15	....	....	134	53	81	.034	.134	.002	0.20	5.20	1.75	70.0	69.0	25,000	+	+	+
Fredonia	Chautauqua	Tap, public supply	12/14/10	35	15	....	....	109	26	83	.012	.060	.001	0.20	3.00	1.50	40.3	40.0	275	+	+	−
Fredonia	Chautauqua	Tap, public supply	2/ 1/11	15	120	....	....	173	47	126	.016	.162	.002	0.30	7.00	1.50	40.3	21.0	17,500	+	+	+
Fredonia	Chautauqua	Tap, public supply	4/17/11	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	3,300	+	−	−
Fredonia	Chautauqua	Tap, public supply	6/ 6/11	25	15	....	....	99	26	73	.010	.064	Tr.	0.30	3.20	1.50	60.0	54.0	200	+	−	−
Fredonia	Chautauqua	Tap, public supply	11/ 4/11	30	20	....	....	130	28	102	.012	.082	.001	0.08	4.20	1.25	78.6	69.0	240	+	+	−
Fredonia	Chautauqua	Tap, public supply	12/ 8/11	15	150	....	....	186	31	155	.012	.096	.010	0.20	3.90	2.25	47.1	39.0	19,500	+	+	−
Fredonia	Chautauqua	Tap, public supply	3/ 6/12	10	5	....	....	115	25	90	.029	.056	.001	0.34	1.60	1.75	88.6	63.0	900	+	+	−
Fredonia	Chautauqua	Tap, public supply	4/16/12	25	130	....	....	120	22	98	.034	.066	.007	0.24	3.20	1.50	50.0	38.0	11,000	+	+	+
Fredonia	Chautauqua	Tap, public supply	9/20/12	15	6	....	....	162	26	136	.008	.084	.001	0.24	3.10	1.75	105.8	87.0	500	+	+	−
Fredonia	Chautauqua	Tap, public supply	12/13/12	20	90	....	....	160	19	141	.018	.114	.002	0.22	5.20	2.00	51.4	45.0	5,100	+	+	−
Fredonia	Chautauqua	Tap, public supply	1/24/13	15	150	....	....	132	....	....	.014	.148	.003	0.30	5.90	2.00	33.8	21.0	1,000	+	+	+
Fredonia	Chautauqua	Tap, public supply	2/21/13	10	35	....	....	123	....	....	.026	.076	.001	0.24	2.90	1.50	52.9	43.0	1,400	+	−	−
Fredonia	Chautauqua	Tap, public supply	4/ 4/13	15	140	....	....	120	....	....	.022	.132	Tr.	0.26	4.30	2.00	31.2	17.0	7,700	+	−	−
Fredonia	Chautauqua	Tap, public supply	5/22/13	20	30	....	....	97	....	....	.016	.106	.001	0.12	3.50	1.25	55.7	47.0	6,900	+	+	−
Fredonia	Chautauqua	Tap, public supply	7/11/13	35	7	....	....	130	....	....	.004	.084	.001	0.22	2.90	1.25	70.0	69.0	1,300	−	−	−
Fredonia	Chautauqua	Tap, public supply	4/14/14	12	160	1 v.	1 v.	74	15	59	.016	.110	Tr.	0.34	5.70	1.75	36.4	22.0	5,300	+	+	+
Fredonia	Chautauqua	Tap at Dr. Luke's residence	6/30/15	5	3	2 v.	2 v.	141	25	116	.004	.026	.002	0.16	3.00	2.00	108.6	74.0	45	+	−	−
Fredonia	Chautauqua	Tap at Dr. Luke's residence	6/30/15	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	120	+	+	−
Fredonia	Chautauqua	Tap at Columbia hotel	6/30/15	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	550	−	−	−

FREEPORT

HERMANN M. BIGGS, M.D., *State Commissioner of Health:*

An investigation of the public water supply of the village of Freeport, Long Island, was made by Mr. C. M. Baker, assistant engineer, on May 14, 1915.

Freeport is located in the county of Nassau, on the Montauk branch of the Long Island railroad, about 36 miles from New York city. The population at the time of the 1910 census was 4,800, but it has probably increased since so that the present population is doubtless not far from 6,000, and it is estimated that during the summer it reaches about 7,000.

The water supply is owned by the village and is operated in connection with a municipal electric lighting plant. The water system consists of wells from which the water is pumped into a standpipe whence it is distributed by gravity through the mains to the consumers. About 75 per cent. or an average of some 5,000 of the population are served with the water. There are 1,600 service taps, of which only 80 are metered. Little definite information could be obtained regarding the water consumption except for the month of April, just prior to the time of the inspection. During this period a recording counter had been in use for registering the strokes of the pumps. This indicated that the consumption for the month of April, 1915, was about 250,000 gallons daily, which corresponds to approximately 50 gallons per capita per day. Judging from the consumption in other villages in this vicinity, it is quite probable that during the summer the consumption will reach nearly 1,000,000 gallons daily. The average pressure is about 50 pounds per square inch, but varies with the elevation of the water in the standpipe.

The source of the supply is six 10-inch wells driven through sand to depths ranging from 45 to 50 feet. The depth of water in the wells is about 28 feet and the water is drawn from a depth of about 20 feet below the normal surface of the ground water. The water is pumped from the wells into the standpipe by two Worthington pumps, each with a rated capacity of 500,000 gallons per day. The suction lift of the pumps is about 10 feet. Located near the pumping station is the standpipe, which is 20 feet in diameter and 125 feet high and has a capacity of about 300,000 gallons. The water mains consist of about 18 miles of 4-inch pipe, 6 miles of 6-inch, 1.5 of 8-inch, 0.5 of 10-inch and 0.4 of 12-inch, or a total of 26.4 miles.

The density of population within a radius of ¼ of a mile of the wells is equivalent to about 500 per square mile, and within a radius of ½ mile to 570 per square mile. The area outside of these limits which probably comes within the limits of the area of influence of the wells has a population of about 200 people per square mile. The wells are located to the west of the power plant in a depression or low place so that the drainage from the immediate surroundings flows towards them. A privy at the power plant located about 140 feet from the nearest well was in an unsatisfactory condition at the time of the inspection. Although it was apparently provided with a removable box it was evident that the box was not tight and was much in need of cleaning. Other sources of pollution in the immediate vicinity consist of a barn and outhouses located on property just to the west of the plant, the barn being about 200 feet from the wells.

A sample of water was collected from one of the pumps at the pumping station and sent to the Division of Laboratories and Research for analysis, the results being as follows:

REPORT OF WATER ANALYSIS FOR FREEPORT

Color		Trace
Turbidity		Clear
Odor, cold		1 v.
Odor, hot		1 v.
Solids, total		50
Loss on ignition		6
Mineral residue		44
Ammonia, free		.192
Ammonia, albuminoid		.016
Nitrites		Trace
Nitrates		2.00
Oxygen consumed		0.50
Chlorine		11.75
Hardness, total		28.60
Alkalinity		6.00
Bacteria per c.c.		35
B. coli type	10 c.c.	0+3—
	1 c.c.	0+3—
	1/10 c.c.	0+3—

Results are expressed in parts per million. + Present. — Absent.
Abbreviations used to describe odors of water: 0, none; 1, very faint; 2, faint; 3, distinct; 4, decided; 5, strong; 6, very strong; a, aromatic; d, disagreeable; e, earthy; f fishy; g, grassy; m, musty; v, vegetable.

It is impossible to satisfactorily judge the character of the water from a single analysis because under different hydraulic conditions of the ground water and at different seasons of the year the results may be entirely different. The results of the analysis of the sample taken at the time of the inspection, however, show figures for free ammonia, nitrates and chlorine which are considerably above the normal. The high nitrates, 2 parts per million together with 11.75 parts per million of chlorine, which is nearly double the normal, indicate that pollution has been finding its way into the ground water supply tributary to the wells although the low bacterial contents 35 per c. c., and the absence of the colon type would indicate that the pollution had been rendered inactive in its passage through the soil. The high figure for free ammonia, however, indicates that unoxidized organic matter is present to some extent and would suggest that the pollution is becoming somewhat active. The pollution is undoubtedly due to the unfortunate location of the wells at a place near the center of a comparatively dense population, the sewage of which is cared for either by leaching cesspools or by privies which are in most cases in an unsatisfactory condition. Even though there were no indications that the pollution is becoming active the existence of inactive pollution, in view of the general unsatisfactory condition of the surroundings with respect to cesspools and privies, is a source of potential danger to the supply because under certain hydraulic conditions of the ground water as when there is a much greater draft on the wells or under certain climatic conditions, it is quite possible that the pollution may become active.

In order to sufficiently remove the present sources of pollution of the water supply to permanently improve its quality, it seems necessary that the village construct a sewer system, and that all cesspools and privies, particularly in the vicinity of the wells, be abandoned and all sewage discharge into the system. Pending this improvement, the pollution in the vicinity of the wells should be eliminated as far as possible by providing water-tight containers for all privies and making all cesspools impervious, within a radius of not less than 500 feet of the wells.

Analyses of the water should be regularly made from time to time to detect the presence of any active contamination which might at any time exist. As the installation of a sewer system will, in all probability, largely prevent the contamination of the ground water, these analyses would serve as corroborative evidence of the beneficial effect of such an installation. Should these analyses, either before or after the installation of the sewerage system, show active contamination of the water supply, steps should be taken at once to develop a new supply of satisfactory sanitary quality or to provide sterilization of the present supply.

It is evident from this investigation that the public water supply of Freeport, although not dangerously polluted at the time of this inspection, is subject to pollution which, while apparently rendered inactive in its passage through the soil, may, at almost any time, become active and dangerous and I would, therefore, recommend:

1. That a complete sewer system, plans for which should be approved by this Department as required by law, be constructed and all sewage, especially in the vicinity of the wells, be discharged into the sewers.

2. That, until the sewer system is constructed, all privies be provided with water-tight containers and all cesspools made impervious within a radius of 500 feet of the wells and that, when cleaned, the contents from them be satisfactorily disposed of in a remote place.

3. That analyses of the water be regularly made from time to time
   (a) To detect any active contamination which might exist, and
   (b) To determine the effect of the above improvements upon the water supply.

4. That, if the analyses show dangerous contamination at any time, steps be taken at once to provide a new and safe supply or to purify the present supply by sterilization with hypochlorite or liquid chlorine, preferably the latter.

Respectfully submitted,

THEODORE HORTON,
Chief Engineer

ALBANY, N. Y., *June* 5, 1915

FULTON

HERMANN M. BIGGS, M.D., *State Commissioner of Health:*

A reinspection of the public water supply of Fulton was made on March 29, 1915, by Mr. E. S. Chase, assistant engineer, accompanied and aided by Dr. Geo. G. Whittaker, health officer.

Previous investigations of this water supply have been made by the engineer-division in the past and full reports of these investigations will be found on page 885 of the thirty-third annual report of this Department, on page 547 of the thirty-fourth annual report and on page 253 of the thirty-fifth annual report.

A full description of the source of this water supply and the waterworks system in general will be found in the previous reports. Briefly, the supply is obtained from four wells or springs south of the city on the east shore of the Oswego river. These springs were developed by sinking steel caissons 20 feet in diameter about 15 feet in the ground. Wells Nos. 1 and 2 are near the pumping station which is about two miles south of the city and Wells Nos. 3 and 4 are about one mile further south. The water from Well No. 4 flows into No. 3 and thence into No. 1 and the water from No. 2 also flows into Well No. 1 which serves as a pump well at the pumping station. Since the time of the inspection in 1914, there has been no change in the waterwarks system except that a recording Venturi meter has been installed at the pumping station. The present daily water consumption is approximately 1,500,000 gallons.

At the time of the recent inspection the Oswego river was somewhat swollen by reason of rains and snow but it was not at an excessive flood stage. The elevation of the river was probably about 1 or 1½ feet lower than at the time of the inspection in 1914. The construction of the barge canal dam and control gates at Fulton has resulted in the control of the elevation of the river within a comparatively small range.

In the previous report made in 1914 the factors affecting the sanitary quality of the water derived from the various wells were carefully gone into and it was pointed out that the water in Springs Nos. 3 and 4 is marked by different chemical constituents from that in Spring No. 2 (and probably Spring No. 1) and that this difference is due in all probability to the effect of local salt deposits or to infiltration into the lower wells of river water carrying a high amount of chlorine and other mineral constituents, or a

combination of both. It was also pointed out that a certain amount of active contamination reaches Springs Nos. 3 and 4 due to seepage into the springs of surface water contaminated with the leachings from the privy, barn and cattle yard of the nearby farm. Several recommendations were, therefore, made for the improvement of the conditions in the vicinity of the various springs in order to prevent contamination from permanent sources and also to prevent accidental or wilful contamination of the springs. It was also recommended that the city authorities inspect and test the piping of the auxiliary water supplies of the various mills in order to discover and prevent any mixture of auxiliary supplies from polluted sources with the public supply in the city mains. Furthermore, it was pointed out that should the quantity of water obtainable from the present springs become insufficient the authorities consider the development of an additional supply of unquestionable purity after careful studies by a competent water supply engineer.

It appears from the recent inspection that none of the recommendations of this Department have been carried out although the purchase of ten acres of land in the vicinity of springs 3 and 4 is contemplated in order to remove the sources of contamination at this point.

At the time of the inspection samples of water were collected from each of the four springs, from the Oswego river, from a brook which flows between springs 3 and 4 and from the new (Tilden) spring, the development of which is being considered by the city. The results of the analyses of these samples made by the Division of Laboratories and Research will be found in the appended table. These analyses show, as other analyses in the past have, the marked difference in the chemical constituents of the water in the two sets of wells connected with the city supply. The bacterial results of the well waters are satisfactory except that of the sample collected from the tap at the pumping station which shows the presence of a small amount of active contamination indicated by the occurrence of organisms of the B. coli type in one of three 10 c. c. inoculations.

The following table gives a comparison of certain chemical and bacterial characteristics of the water from the individual wells, the Oswego river and the new spring which it is planned to use in connection with the present system:

DATE	PARTS PER MILLION			Bacteria per c.c.	B. COLI TYPE		
	Chlorine	Total solids	Hardness		10 c.c.	1 c.c.	1-10 c.c.
			OSWEGO RIVER				
March 30, 1914.....	52.0	300	140	47,500	3+0—	3+0—	2+1—
March 29, 1915.....	112.5	433	165.8	250	3+0—	1+2—	0+3—
			WELL No. 2				
March 27, 1913.....	275	....	....	650	+	—	—
April 11, 1913.....	240	636	188.6	80	+	—	—
March 30, 1914.....	545	1,200	165.8	10	0+3—	0+3—	0+3—
March 29, 1915.....	625	1,364	350.0	10	0+3—	0+3—	0+3—
			(TILDEN) WELL No. 2¼				
March 30, 1914.....	20	205	36	20	0+3—	0+3—	0+3—
March 29, 1915.....	9	236	179	10	0+3—	0+3—	0+3—
			WELL No. 3				
March 27, 1913.....	2.87	128	97.2	220	+	+	—
April 11, 1913.....	3.12	144	91.4	70	+	—	—
March 30, 1914.....	2.87	133	92.9	7,300	3+0—	0+3—	0+3—
March 29, 1915.....	7.00	187	128.6	25	0+3—	0+3—	0+3—
			WELL No. 4				
March 27, 1913.....	2.00	119	87.1	300	+	+	—
April 11, 1913.....	....	....	....	15	—	—	—
March 30, 1914.....	2.25	123	82.9	120	1+2—	0+3—	0+3—
March 29, 1915.....	4.25	114	91.4	15	0+3—	0+3—	0+3—
			TAP (MIXED WATERS FROM WELLS 1, 2, 3 AND 4)				
March 27, 1913.....	88.0	321	154.2	500	+	+	—
March 11, 1913.....	79.0	313	165.0	80	—	—	—
March 30, 1914.....	190.0	569	208.0	1,600	2+1—	0+3—	0+3—
March 29, 1915.....	142.5	413	128.6	45	1+2—	0+3—	0+3—
March 20, 1915.....	....	....	....	10	0+3—	0+3—	0+3—

The particular characteristic shown by this table is that the mineral content in the water from the lower wells seems to have been somewhat greater at the time of the present inspection than in earlier years. The bacterial results in the recent samples from all the wells are somewhat better than previously.

The two sets of analyses of the new or Tilden spring show satisfactory results. It should be noted, however, that these samples were taken when the draft upon the well was very slight and the analyses cannot indicate with accuracy the sanitary condition of the water when the draft upon the well becomes much greater. Considering the sanitary surroundings of this well, however, it would seem that it should supply water of satisfactory quality and I would suggest that a temporary connection be made with the pipe line to the pumping station and a portable pumping apparatus be employed to deliver water from this well. As the draft upon the well increases it would be desirable to collect samples for analyses at frequent intervals. If after extended observation of the well samples should show satisfactory analytical results it would then be time for the city authorities to consider its permanent development.

In view of the above facts the following conclusions may be drawn:

1. That the city authorities have not carried out the recommendations of this Department made in the report of 1914.
2. That the need for these recommendations still exists, this conclusion being confirmed not only by the inspection but also by the occurrence of a small amount of active contamination in one of the samples of the mixed supply.
3. That, if required, water might be obtained from the Tilden well if precautions are taken to prevent any accidental contamination of the supply and providing frequent analyses are made to confirm its sanitary quality.

I would therefore recommend:

1. That the city authorities be urged to give their immediate attention to the carrying out of the recommendations in the report of 1914.
2. That in case the Tilden well is developed it be developed along the lines suggested in this report.

Respectfully submitted,
THEODORE HORTON,
Chief Engineer

ALBANY, N. Y., *April* 23, 1915

RESULTS OF WATER ANALYSES

Abbreviations used to describe odors of water: 0, none; 1, very faint; 2, faint; 3, distinct; 4, decided; 5, strong; 6, very strong; a, aromatic; d, disagreeable; e, earthy; f, fishy; g, grassy; m, musty; v, vegetable

Municipality	County	Source of sample	Date of collection	Physical				Chemical (Parts Per Million)											Bacteriological			
						Odor		Solids			Nitrogen as—						Hardness			B. Coli Type (+ = present, — = absent)		
				Color	Turbidity	Cold	Hot	Total	Loss on ignition	Mineral residue	Free ammonia	Albuminoid ammonia	Nitrites	Nitrates	Oxygen consumed	Chlorine	Total	Alkalinity	Bacteria per c.c.; gelatin 20°, 48 hours	10 c.c.	1 c.c.	1-10 c.c.
Fulton	Oswego	Oswego river	3/29/15	8	5	2 v.	2 v.	433	65	368	.086	.102	.005	0.24	5.80	112.5	165.8	95.0	250	3+0—	1+2—	0+3—
Fulton	Oswego	Well No. 4	3/29/15	Tr.	Tr.	1 v.	1 v.	114	10	104	.022	.028	.001	1.00	1.50	4.25	91.4	90.0	15	0+3—	0+3—	0+3—
Fulton	Oswego	Brook between wells Nos. 3 and 4	3/29/15	8	2	1 v.	1 v.	95	30	65	.018	.102	.002	0.01	5.05	1.88	58.6	58.0	150	0+3—	0+3—	0+3—
Fulton	Oswego	Well No. 3	3/29/15	Tr.	Tr.	1 v.	1 v.	187	40	147	.018	.010	.008	0.60	1.60	7.00	128.6	127.0	25	0+3—	0+3—	0+3—
Fulton	Oswego	Tilden well	3/29/15	Tr.	Tr.	2 a.	2 a.	236	39	197	.016	.040	.002	0.04	2.00	9.13	179.0	169.0	10	0+3—	0+3—	0+3—
Fulton	Oswego	Well No. 2	3/29/15	Tr.	Cl.	1 v.	1 v.	1364	244	1120	.142	.030	.002	0.30	4.80	625.00	356.0	126.0	10	0+3—	0+3—	0+3—
Fulton	Oswego	Tap at pumping station	3/29/15	Tr.	Cl.	1 v.	1 v.	413	72	341	.006	.002	.001	1.00	2.00	142.50	128.6	111.0	45	1+2—	0+3—	0+3—
Fulton	Oswego	Tap in city	3/29/15	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	10	0+3—	0+3—	0+3—

2. That the occasional occurrence of tastes and odors in the village supply may be due either to hydrogen sulphide or other mineral constituents of the deep well or to growths of algae in the water stored in the open distributing reservoir.

3. That the Starin system, although of insufficient quality and inadequate pressure for a public supply, is of a reasonably satisfactory sanitary quality, subject, however, to contamination by surface wash at times of rainfall.

I would therefore recommend:

1. That the Fultonville Water Company take immediate steps to remove the privies located near their well or else provide them with watertight removable containers to be cleaned at proper intervals and the contents disposed of in a satisfactory and sanitary manner.

2. That the village authorities require all cesspools and privies in the village to be abandoned and all houses to be connected with the village sewer system in order to minimize the pollution of the ground water. No sewer, however, should be laid in the street in the vicinity of the pumping station on account of the danger of possible overflow or leakage.

3. That the water company, in case of serious trouble with algae should occur in the future, provide the storage reservoir with a roof in order to exclude sunlight.

4. That the water company have frequent and regular analyses made of their supply in order to detect at any time in the future the occurrence of active contamination.

5. That should such analyses show the presence of continued and active contamination, the water works company consider the advisability of securing a new and adequate supply of water from a source more favorably located, with reference to possible contamination.

6. That the owners of the Starin system, if this supply is continued to be used in part by the village, improve the sources of supply by the development and protection of the springs in such a manner that surface water will be excluded at times of rainfall.

Respectfully submitted,
THEODORE HORTON,
Chief Engineer

ALBANY, N. Y., *June* 15, 1915

REPORT OF WATER ANALYSIS FOR FULTONVILLE

Source		Tap, public supply*	Tap, public supply †	Tap, Starin supply
Collected on		5/3/11	5/10/15	5/10/15
Color		10	5	Trace
Odor, hot		....	1 v	1 v
Odor, cold		....	1 v	1 v
Turbidity		15	5	3
Solids, total		290	255	353
Loss on ignition		17	12	80
Mineral residue		273	243	273
Ammonia, free		.036	.628	.002
Ammonia, albuminoid		.026	.008	.004
Nitrites		.003	.003	.002
Nitrates		0.14	.006	0.80
Oxygen consumed		1.30	0.80	0.70
Chlorine		7.00	15.00	2.88
Hardness, total		214.5	208.0	208.0
Alkalinity		196.0	205.0	206.0
Bacteria per c.c.		10,000	1,000	140
B. coli type	10 c.c.	+	—	—
	1 c.c.	—	—	—
	1/10 c.c.	—	—	—

* Two days in transit. † Sample at pumps.
Results are expressed in parts per million: + Present. — Absent.

dry season than in the winter months. The fluctuations in the ground water take place very slowly showing that the water is obtained largely from the interior of the hill and not from the surface. Around the large spring a ditch has been excavated to carry away any surface water that might flow toward the spring.

At the time of the inspection of the supply a sample was obtained from a tap in the village and the analysis will be found in the following table.

REPORT OF WATER ANALYSIS FOR GILBOA

Source		Tap connected with public supply,
Laboratory No.		B-1044, C-1045
Collected on		8/6/15
Color		Trace
Turbidity		Trace
Odor, cold		1 v.
Odor, hot		1 v.
Solids, total		60
Loss on ignition		9
Mineral residue		51
Ammonia, free		.054
Ammonia, albuminoid		.020
Nitrites		.001
Nitrates		.060
Oxygen consumed		0.90
Chlorine		1.5
Hardness, total		37.7
Alkalinity		30.00
Bacteria per c.c.		150
B. coli type	10 c.c. inoculations	3+0—
	1 c.c. inoculations	1+2—
	1/10 c.c. inoculations	0+3—

This analysis shows that the water has only a trace of color and turbidity and odor. The organic matter is comparatively small as shown by the figures for nitrogen and for oxygen consumed. The water is moderately soft as shown by results for hardness and alkalinity. The total number of bacteria is moderate although bacteria of the B. coli group are found in samples as small as 1 c. c. From this analysis it is evident that the water contained a small amount of pollution due to some surface water which reached the springs from the rain the night before the inspection.

As a result of this investigation and analysis the following conclusions may be drawn:

1. That the water from this supply is apparently of a fairly satisfactory sanitary quality although evidently subject to some pollution from surface water during rain storms.
2. That the spring protected by a pile of stones is open to a greater opportunity for pollution than those springs protected by concrete curb with cover.
3. That the benefit of storage in the reservoir is not utilized since the water passes directly from the spring to the consumers.

In view of the above conclusions I would recommend that the water company make the following improvements at the springs and reservoir;

1. Develop and protect the spring protected by stones only in a manner similar to the other springs.
2. Abandon the cultivation of land in the immediate vicinity of the spring.
3. Rearrange the piping in the reservoir so that the water enters the same at one end and passes out at the other end.

Respectfully submitted,
THEODORE HORTON,
Chief Engineer

ALBANY, N. Y., *September* 13, 1915

GLENS FALLS

HERMANN M. BIGGS, M.D., *State Commissioner of Health:*

A reinspection of the public water supply of Glens Falls was made on July 14, 1915, by Dr. C. S. Prest, sanitary supervisor of District "G". A previous investigation of this supply was made in 1910 by the Engineering Division, a full report of which will be found on page 558 of the thirty-first annual report of this Department. Another report upon this water supply will be found on page 889 of the thirty-third annual report, this report having been made by Professor H. N. Ogden in connection with his investigation of the sanitary condition of the city as affected by its water supply.

The public water supply of Glens Falls is obtained by gravity from adjacent catchment areas located on the eastern slope of the Luzerne Mountains. There are three intakes known respectively as the Butler, Wilkie and Keenan intakes. The description of these intakes, storage reservoirs and water works system in general remains practically the same as given in the earlier report. Rules and regulations for the sanitary protection of this water supply were enacted by this Department in 1912.

The watershed areas tributary to the various intakes are respectively 2.5, 1.7 and 1.6 square miles for the Butler, Wilkie and Keenan areas or a total of 5.8 square miles. There are no houses upon any of these areas, and consequently no resident population. The principal danger to the sanitary quality of the supply would come from chance visitors upon the watershed such as fishermen, hunters, picnic parties, etc. At times of rainfall a certain amount of turbidity is washed into the stream and decaying vegetation upon the watershed and in the reservoirs brings about a considerable amount of color in the water.

The report made in 1910 gave as its conclusion that the water supply of Glens Falls was of a good sanitary quality, although it was recommended:

1. That the Board of Water Commissioners make regular sanitary inspections of the total watershed and that they require that that part of the stream running through pasture land be kept free of accumulations of manure.

2. That, should the Board of Water Commissioners experience any difficulty in abating the insanitary conditions or otherwise find it impracticable to thus protect their watershed, they should consider the question of application to this Department for enactment of rules and regulations in accordance with the provisions of Sections 70 and 71 of the Public Health Law.

In the report of Professor Ogden it was concluded that although analyses made of the water supply showed the presence of organic matter and occasionally high bacterial counts and although bacteria of the B. coli type were frequently found in 10 c. c. samples, it was evident that the water contains foreign matter of vegetable origin, only, and not essentially of a disease producing character. It was, therefore, recommended:

1. That the Board of Water Commissioners persevere in their policy of acquiring property upon the watershed.

2. That the Water Board make regular and frequent inspections of the watershed and particularly of those areas adjacent to the streams and between the storage reservoirs and the intakes; that they prohibit fishing from the reservoirs; and that they require those areas adjacent to the brooks to be kept free from manure and the brooks themselves from cattle.

At the time of his inspection Dr. Prest collected samples of water from each of the intakes and storage reservoirs and also from the tap in the city, the results of the analyses of these samples together with others made in the past by the Division of Laboratories and Research will be found in the appended table.

These analyses show a relatively soft water, rather high in color and at times with some turbidity. The occurrence of decomposing and decomposable organic matter as indicated by the results of nitrogen in its various forms is due undoubtedly to the presence of decaying vegetation rather than to the occurrence of pollution of animal or human origin. The total number of bacteria are as a rule moderate for an unpurified surface supply and the occasional occurrence of organisms of the B. coli type is due probably to chance contamination by animals and, possibly, by human visitors rather than to permanent sources of contamination.

In view of the above facts, the following conclusions may be drawn:

1. That the recommendations of the earlier reports of this Department have apparently been carried out.
2. That the water supply of Glens Falls is probably as well protected from contamination of human origin as is possible in the case of an unpurified surface supply.
3. That the water supply is, however, open to accidental, incidental or wilful contamination due to chance visitors upon the watershed.
4. That the esthetic quality of the supply is depreciated by the comparatively high color and the occasional turbidity.

I would, therefore, recommend:

1. That the Board of Water Commissioners install and carefully operate proper apparatus for the sterilization of the supply with liquid chlorine in order to eliminate as far as possible the danger of accidental contamination.
2. That, if the desired results warrant the expenditure, the city authorities consider the installation of a modern filtration plant supplemented by aeration in order to eliminate turbidity and odors and to reduce color.

Respectfully submitted,

THEODORE HORTON,
Chief Engineer

ALBANY, N. Y., *August* 26, 1915

RESULTS OF WATER ANALYSES

Municipality	County	Source of sample	Date of collection	Physical: Color	Physical: Turbidity	Physical: Odor: Cold	Physical: Odor: Hot	Chemical (Parts per Million): Solids: Total	Solids: Loss on ignition	Solids: Mineral residue	Nitrogen as—: Free ammonia	Nitrogen as—: Albuminoid ammonia	Nitrogen as—: Nitrites	Nitrogen as—: Nitrates	Oxygen consumed	Chlorine	Hardness: Total	Hardness: Alkalinity	Bacteriological: Bacteria per c.c.; gelatin 20°, 48 hours	B. Coli Type (+ = present, — = absent): 10 c.c.	B. Coli Type: 1 c.c.	B. Coli Type: 1-10 c.c.
Glens Falls	Warren	Tap, public supply	1/31/12	25	Cl.	....	....	42	16	26	.050	.044	Tr.	0.16	3.40	0.25	15.6	13.0	190	+	+	—
Glens Falls	Warren	Tap, public supply	3/13/12	20	Cl.	....	....	42	15	27	.038	.084	Tr.	0.14	3.10	0.25	19.5	6.0	300	—	—	—
Glens Falls	Warren	Tap, public supply	4/19/12	10	Cl.	....	....	26	6	20	.006	.028	.001	0.02	1.90	0.50	9.5	5.0	110	+	—	—
Glens Falls	Warren	Tap, public supply	9/18/12	40	1	....	....	58	25	33	.006	.090	.001	0.08	5.60	0.37	18.2	13.0	2,750	+	+	—
Glens Falls	Warren	Tap, public supply	11/13/12	45	Tr.	....	....	41	11	30	.012	.140	Tr.	0.04	6.80	1.00	20.8	10.0	250	+	—	—
Glens Falls	Warren	Tap, public supply	12/28/12	40	Tr.	....	....	47	22	25	.016	.096	.001	0.10	5.30	0.25	15.6	10.0	70	+	+	—
Glens Falls	Warren	Tap, public supply	2/20/13	25	Cl.	....	....	34	....	....	.014	.094	Tr.	0.10	3.90	0.50	19.5	9.0	90	+	—	—
Glens Falls	Warren	Tap, public supply	4/25/13	15	2	....	....	40	....	....	.006	.042	Tr.	0.06	2.30	0.50	11.1	6.0	900	—	—	—
Glens Falls	Warren	Tap, public supply	6/28/13	25	2	....	....	38	....	....	.020	.088	.001	0.10	3.00	0.50	22.1	11.0	650	+	—	—
Glens Falls	Warren	Tap, public supply	4/ 9/14	15	1	1 v.	1 v.	27	7	20	.008	.060	Tr.	0.02	2.90	0.75	9.5	4.0	400	+	—	—
Glens Falls	Warren	Tap, public supply	9/ 5/14	35	2	1 v.	1 v.	38	18	20	Tr.	.028	Tr.	0.14	3.50	0.50	19.5	11.0	.....	.....	.....	.....
Glens Falls	Warren	Butler reservoir	9/ 4/14	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	*12,500	+	—	—
Glens Falls	Warren	Keenan reservoir	9/ 4/14	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	*500	+	+	—
Glens Falls	Warren	Wilkie intake	7/14/15	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	90	3+0—	1+2—	0+3—
Glens Falls	Warren	Butler reservoir	7/14/15	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	140	3+0—	0+3—	0+3—
Glens Falls	Warren	Butler intake	7/14/15	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	200	3+0—	1+2—	0+3—
Glens Falls	Warren	Keenan intake	7/14/15	8	3	2 v.	2 v.	48	35	13	.006	.022	.001	.080	3.50	0.50	12.7	8.0	80	3+0—	0+3—	0+3—
Glens Falls	Warren	Tap, public supply	7/14/15	10	2	2 v.	2 v.	56	30	26	.006	.054	.001	.040	6.00	0.50	16.9	16.0	150	3+0—	0+3—	0+3—

* Ice melted in container.

GOSHEN

HERMANN M. BIGGS, M.D., *State Commissioner of Health:*

A reinspection of the public water supply of Goshen was made on August 10, 1915, by Dr. C. W. Berry, sanitary supervisor of District "N". A previous investigation of this supply was made in 1912 by the Engineering Division, the report of which will be found on page 663 of the thirty-third annual report of this Department.

The water supply of Goshen is derived from an artificial lake formed by a dam across a small tributary of the Wallkill river. The water works system in general remains practically the same as described in detail in the earlier report and is owned and operated by the municipality.

The lake or reservoir forming the source of the water supply is located about one and one-half miles south of the village. It is a long, narrow, irregular body of water situated near the head waters of the stream. The area of the watershed tributary to the reservoir is only about one-half square mile and the water surface of the reservoir is approximately twenty-five acres. Upon this watershed there are three dwellings. One of these is located near the northern end of the reservoir about one-eighth of a mile distant from the water's edge. A second house is located east of the central part of the reservoir on low land, some 500 feet distant. The third house, known as the Banker Farm, is located near the southern end of the reservoir and about 300 feet distant. At this place drainage from the farm buildings, barnyard and privy must at times of rainfall reach the reservoir. The insanitary conditions at this place were pointed out in the earlier report but have not as yet been corrected.

At times of low water in the reservoir considerable trouble is experienced from algae growths which bring about disagreeable tastes and odors in the water. Furthermore, the quantity of the supply is barely sufficient to supply the needs of the village. A new sewer system has been constructed in the village and it is expected that the use of this system will bring about a marked increase in water consumption. It, therefore, seems extremely probable that the present supply will be totally inadequate for the needs of the village.

Reports have been submitted to the village by various consulting engineers relative to methods for obtaining additional supply, but as yet these reports have not been acted upon.

At the time of the previous report it was pointed out that the watershed of the supply was for the most part in a reasonably satisfactory sanitary condition, but that the sanitary quality was injured by the drainage received into the reservoir from the Banker farm. It was, therefore, recommended:

1. That the flow from the ditch draining the Banker farm be diverted from the reservoir by constructing the proper channels to carry the water to the eastward of the highway in such a way as to be dissipated on the land, but not to flow in any direct line or lines of drainage to the stream tributary to Otter Kill.
2. That the important questions of improving the quality of the present water supply, increasing the yield of the present watershed and providing for the development of the future water supply needs of Goshen be immediately and carefully considered by the Board of Water Commissioners along the lines recommended by Mr. James Fuertes in his report of November 8, 1901.
3. That should the basin adjacent to the Burrell farm be developed as a source of water supply, the privy and other sources of possible pollution at or near the dwelling already mentioned as being on this watershed be removed to a safe distance from the high-water mark of the reservoir.
4. That regular inspections be made of the reservoir and all tributary watersheds to prevent any accidental, careless or unforeseen pollution reaching the water supply.

5. That if any difficulty is experienced by the Board of Water Commissioners in protecting the public water supply from contamination, they apply to this Department for rules and regulations for the sanitary protection of this supply.

From the report of Dr. Berry it appears that none of these recommendations have been acted upon by the village authorities, although it is evident that the need for them still exists.

At the time of his inspection Dr. Berry collected samples of the water and the results of the analyses of these samples together with others made in the past by the Division of Laboratories and Research will be found in the appended table.

The analyses show a soft water, rather high in color and at times turbid. Decomposing and decomposable organic matter is present in rather more than moderate amounts and the chlorine content is about normal for this region. The bacterial counts are usually high and at times excessive even for a surface supply. Organisms of the B. coli type are nearly always present in 10 c. c. and occasionally in 1 c. c. indicating active contamination of animal or human origin.

In view of the above facts the following conclusions may be drawn:

1. That the recommendations of this Department have not been carried out by the local authorities.

2. That the water supply of Goshen is barely sufficient in quantity to supply the needs of the village at present and with the adoption of a complete sewer system for the village the water consumption will probably be largely increased in the future.

3. That the esthetic quality of the supply is depreciated by the occurrence of tastes and odors due to algae growths.

4. That the sanitary quality of the supply, as clearly pointed out in the previous report, is menaced by the drainage from the farm buildings and privy at the Banker farm.

5. That the supply, as is true of all unpurified surface supplies, is open to chance contamination of an accidental or wilful nature by persons residing upon or passing over the watershed.

I would, therefore, recommend:

1. That in general the village authorities give their careful attention to the recommendations of the previous report.

2. That in particular the village consider at once the necessary steps to provide additional water supply.

3. That, pending the development of an additional supply, the water works officials take action to improve and protect the present supply by:

(a) Applying, under competent supervision, copper sulphate to the water of the lake in case of algae trouble.

(b) Remedying the insanitary conditions at the Banker farm.

(c) Installing and carefully operating apparatus for the sterilization of the supply with liquid chlorine in order to avoid all danger of accidental contamination or infection.

Respectfully submitted,

THEODORE HORTON,
Chief Engineer

ALBANY, N. Y., *September* 23, 1915

RESULTS OF WATER ANALYSES

Municipality	County	Source of sample	Date of collection	PHYSICAL				CHEMICAL (PARTS PER MILLION)											BACTERIOLOGICAL			
						ODOR		SOLIDS			NITROGEN AS—						HARDNESS			B. COLI TYPE + = PRESENT — = ABSENT		
				Color	Turbidity	Cold	Hot	Total	Loss on ignition	Mineral residue	Free ammonia	Albuminoid ammonia	Nitrites	Nitrates	Oxygen consumed	Chlorine	Total	Alkalinity	Bacteria per c.c.; gelatin 20°, 48 hours	10 c.c.	1 c.c.	1-10 c.c.
Goshen	Orange	Tap, public supply	1/26/12	10	Cl.	....	....	55	....	37	.028	138	.001	0.14	2.30	1.75	27.3	14.0	190	+	—	—
Goshen	Orange	Tap, public supply	2/29/12	10	5	....	....	57	....	47	.022	.154	Tr.	0.14	4.00	2.00	27.3	13.0	3,500	+	—	—
Goshen	Orange	Tap, public supply	4/4/12	15	5	....	....	70	....	54	.008	.128	Tr.	0.04	3.60	1.50	16.9	10.0	2,500	+	—	—
Goshen	Orange	Tap, public supply	10/ 4/12	25	Tr.	....	....	58	....	48	.004	.194	Tr.	0.06	5.00	1.75	32.5	25.0	1,700	+	—	—
Goshen	Orange	Tap, public supply	11/ 8/12	22	5	....	....	70	....	38	.014	.212	.001	0.10	5.50	2.00	33.8	26.0	700	—	—	—
Goshen	Orange	Tap, public supply	12/30/12	20	10	....	....	62	....	40	.040	.186	001	0.04	4.00	0.75	33.8	25.0	350	—	—	—
Goshen	Orange	Tap, public supply	1/29/13	....	12	....	....	74	....	....	.024	.218	Tr.	0.16	3.50	1.50	28.6	18.0	500	—	—	—
Goshen	Orange	Tap, public supply	3/12/13	30	15	....	....	91	....	....	.020	.242	Tr.	0.06	4.60	1.75	24.7	15.0	850	—	—	—
Goshen	Orange	Tap, public supply	4/16/13	10	10	....	....	60	....	....	.038	.190	.001	0.04	4.00	1.75	29.8	15.0	150	—	—	—
Goshen	Orange	Tap, public supply	5/28/13	12	Tr.	....	....	59	....	....	.014	.130	Tr.	0.10	2.90	1.75	29.9	21.0	30	—	—	—
Goshen	Orange	Tap, public supply	7/ 9/13	20	2	....	....	60	....	....	.004	.182	.002	0.22	3.90	1.50	28.6	20.0	......	+	+	—
Goshen	Orange	Tap, public supply	3/24/15	15	2	2 v.	2 v.	69	20	49	.020	.136	.001	0.24	3.40	2.25	31.2	22.0	30	—	—	—
Goshen	Orange	Tap, public supply	8/10/15	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	200	2+1—	1+2—	0+3—
Goshen	Orange	Reservoir near intake	9/10/15	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	500	3+0—	2+1—	1+2—

GOWANDA

HERMANN M. BIGGS, M.D., *State Commissioner of Health:*

A reinspection of the public water supply of the village of Gowanda was made on March 10, 1915, by Dr. John J. Mahoney, sanitary supervisor of District "M". A full report of a previous investigation of this supply made by the Engineering Division in 1912 will be found on page 667 of the thirty-third annual report of this Department.

The public water supply of Gowanda is derived from five groups of comparatively small springs located on the hills a short distance to the east of the village. The water from two groups of springs flows directly to a small pond which acts as a storage and distribution reservoir. The water from the other springs flows directly to the distribution system without entering the reservoir. The description of the various springs, their location, and the method of their development and of the water works system in general is the same as at the time of the earlier report. The water works are owned and operated by the Gowanda Water Works Company.

The earlier report pointed out that the majority of the springs were subject to intermittent pollution during heavy rains and wet weather from lands dressed with manurial fertilizer, pasture lands, animal inclosures, and possibly from some human organic matter from the dwelling houses immediately above the group of springs known as the Bridges Springs. It was also noted that the discharge of spring water collected in open channels directly into the village mains with no adequate opportunity for sedimentation in the reservoir or other suitable settling basin caused undesirable turbidity in the supply during the heavy rains and that, while the pollution from the above-mentioned sources had probably not been excessive, it was undesirable and, in the event of sickness near some of the springs, would be a menace to the health of the village.

It was, therefore, recommended:

1. That all dangerous and undesirable pollution be removed from the public water supply by:
   (a) Removing all sources of pollution to a safe distance from the immediate surroundings of the springs.
   (b) The construction of deep and properly constructed ditches or cut-off trenches to effectively prevent polluted storm water from passing into the public water supply.
2. That the turbidity in the water caused by the erosive action of heavy rains be corrected by:
   (a) Paving the springs and collecting channels and protecting them from surface flow.
   (b) Passing the whole public water supply through adequately large and suitable settling tanks.
3. That, owing to the difficulty of protecting the many sources of water supply from organic and possibly dangerous pollution and the expense of installing works for preventing fouling of the water by suspended matter at certain seasons, the water company investigate other possible sources of water supply for the village with a view to replacing the present sources of supply by some other adequate and unpolluted source whose sanitary quality can be readily controlled.
4. That regular and frequent inspection be made by the Gowanda Water Works Company of all sources of public water supply for the village in order to prevent direct and permanent pollution and to minimize the opportunities for accidental or careless pollution of this supply.

From the report of Dr. Mahoney, it appears that the above-described unsatisfactory conditions remain the same as in 1912 and furthermore that none of the recommendations of this Department has been carried out except that inspections are made more or less frequently of the watershed.

At the time of the inspection, Dr. Mahoney collected samples of the water, the results of the analyses of which together with others made in the past by the Division of Laboratories and Research will be found in the appended table.

These analyses show a very hard water, which is, at times, colored and turbid due probably to the influence of surface wash. At other times, the water is clear and colorless. The figures for nitrogen in its various forms are somewhat variable, which is doubtless explained by the variations in the amount of surface water present. The nitrates and chlorine are particularly high, indicating pollution by animal or vegetable organic matter. The bacteriological results are frequently unsatisfactory, being high in total numbers, with organisms of the B. coli type present occasionally in samples as small as 1 c. c. and even 1/10 c. c. At other times, these organisms are absent, indicating that contamination occurs intermittently probably at times of rainfall when surface wash reaches the springs.

In view of the above facts, the following conclusions may be drawn:

1. That practically none of the recommendations of this Department has been carried out.
2. That unsatisfactory conditions are still existing which render the springs liable to contamination by surface wash from manured fields, barnyards, and from the vicinity of dwellings.

I would, therefore, recommend that the officials of the water works company give their immediate attention to the carrying out of the recommendations made in the previous report as given in detail above.

Respectfully submitted,

THEODORE HORTON,
Chief Engineer

ALBANY, N. Y., *June* 1, 1915

RESULTS OF WATER ANALYSES

Municipality	County	Source of sample	Date of collection	Physical				Chemical (Parts per Million)											Bacteriological			
						Odor		Solids			Nitrogen as—						Hardness			B. Coli Type + = present — = absent		
				Color	Turbidity	Cold	Hot	Total	Loss on ignition	Mineral residue	Free ammonia	Albuminoid ammonia	Nitrites	Nitrates	Oxygen consumed	Chlorine	.otal	Alkalinity	Bacteria per c.c.; gelatin 20°, 48 hours	10 c.c.	1 c.c.	1-10 c.c.
Gowanda......	Cattaraugus...	Tap, public supply.........	9/25/12	15	6	....	....	200	17	183	.006	.074	.001	0.02	3.70	1.75	157.2	149.0	6,600	+	+	+
Gowanda......	Cattaraugus...	Tap, public supply.........	11/12/12	7	3	....	....	199	22	177	.008	.038	.001	0.92	1.60	1.62	142.8	131.0	9,200	+	+	—
Gowanda......	Cattaraugus...	Tap, public supply.........	12/16/12	Tr.	Cl.	....	....	200	30	170	.024	.028	.003	2.40	1.30	2.25	142.8	140.0	2,100	—	—	—
Gowanda......	Cattaraugus...	Tap, public supply.........	1/25/13	Tr.	Cl.	....	....	188	....	....	.006	.010	Tr.	3.40	0.50	2.50	134.2	134.0	60	+	—	—
Gowanda......	Cattaraugus...	Tap, public supply.........	2/22/13	5	Tr.	....	....	172	....	....	.018	.036	Tr.	2.00	0.60	2.50	148.6	124.0	500	—	—	—
Gowanda......	Cattaraugus...	Tap, public supply.........	4/ 5/13	Tr.	Cl.	....	....	219	....	....	.008	.020	Tr.	1.70	0.60	2.00	131.4	126.0	2,900	—	—	—
Gowanda......	Cattaraugus...	Tap, public supply.........	5/23/13	Tr.	Tr.	....	....	192	....	....	.002	.006	.001	4.00	0.10	2.50	134.2	121.0	3,600	—	—	—
Gowanda......	Cattaraugus...	Tap, public supply.........	4/16/14	5	8	1 v.	1 v.	166	31	135	.028	.050	.001	0.80	2.50	1.50	125.8	115.0	550	+	—	—

GUILFORD

HERMANN M. BIGGS, M.D., *State Commissioner of Health:*

An investigation of the public water supply of Guilford was made on September 23, 1915, by Mr. C. M. Baker, assistant engineer, accompanied by Dr. F. S. Heimer, health officer.

Guilford is an unincorporated village of about 400 inhabitants located in the town of Guilford, Chenango county, on the New York, Ontario and Western railroad about nine miles southwest of the village of Sidney.

The water supply is owned and controlled by the Moses Brothers Water Works. The owners of the water works formerly operated a mill in the village, but about three years ago sold out their interests in the mill and moved to Eaton, their only local representative now being a resident of the village, who looks after the water rents. The water supply is derived from a mill pond just below the outlet of Guilford lake. From the intake the water is distributed by gravity to the consumers. Between 60 and 70 per cent. of the population is served with the water. There is a total of about 40 service taps, none of which is metered. No definite information could be obtained regarding the water consumption, but based on a per capita rate of 100 gallons daily the total daily consumption would be approximately 26,000 gallons. The pressure in the village is 20 or 25 pounds per square inch.

A concrete dam has been constructed across the outlet of Guilford lake, equipped with suitable gates for the purpose of conserving the water supply in the lake for operating the mill. About 150 feet below this dam another concrete dam forms a pond approximately 100 feet wide by 150 feet long, from which the supply from the mill and also the water supply for the village is obtained directly. The water supply intake is covered with a brass strainer. The water mains consist of about 1½ miles of pipe ranging in size from 2 to 6 inches in diameter.

Guilford lake is approximately three-eighths of a mile long and one-quarter of a mile wide. It is fed principally by springs, there being no well-defined inlet. Located along the shores of the lake are some 12 summer cottages, the privies of which are located in some cases only 100 to 150 feet from the lake and equipped with earth vaults only. There are also numerous campers on the shore of the lake during the summer. The lake is used extensively for bathing, fishing and boating.

The New York, Ontario and Western railroad passes along the top of a steep bank within about 20 feet of the edge of the water in the mill pond from which the supply is derived. On the opposite side of the pond a highway passes within about 20 feet of the water's edge. Between this highway and the pond is a platform for loading ice in the winter and also a building which contains a hoisting engine for drawing the ice from the lake. Ice for one or two creameries and for other local consumption is harvested near the outlet of the lake just above the upper dam. Four boathouses are also located at the head of the outlet just above the dam.

It is apparent from the facts stated above that there are numerous sources of pollution of the lake water in the summer from the inhabitants of the cottages and campers along the shores of the lake and in the winter from people cutting ice near the source of the supply.

Samples of the water were collected and sent to the Division of Laboratories and Research for analysis, the results of which are appended.

The results of the analyses show that the water was comparatively high in color, that there was some organic matter present, as indicated by the figures for free and albuminoid ammonia, and that the chlorine content was above normal. The bacterial count in the sample collected from a tap in the village was high, although the count was low in the sample collected from a tap in the depot. Colon bacilli, however, were found present in both of these samples, thus indicating the presence of active contamination at the time of the investigation.

As a result of this investigation, it is apparent that the water supply of Guilford is subject to considerable contamination from summer residents in

the cottages, from campers along the shores of Guilford lake, from people cutting ice on the lake just above the water intake during the winter, and from the highway and railroad which pass near the pond from which the supply is taken. That pollution from these sources finds its way into the water supply is also borne out by the analytical results.

In view of the above, I beg to offer the following recommendations to be acted upon by the water company:

1. That the water supply intake be extended into Guilford lake itself to a point where there will be the least apparent opportunity for pollution.
2. That the supply be sterilized with liquid chlorine or purified by some other equivalent treatment.
3. That in case it seems impracticable to carry out the above recommendations the present supply be abandoned and a new supply obtained from another source of a satisfactory quality and of sufficient quantity.

Respectfully submitted,

THEODORE HORTON,
Chief Engineer

ALBANY, N. Y., *December* 30, 1915

REPORT OF WATER ANALYSIS FOR GUILFORD

		Tap at hotel	Tap at depot
Source		Tap at hotel	Tap at depot
Collected on		9/23/15	9/23/15
Color		8	....
Odor, hot		2 a.	....
Odor, cold		2 a.	....
Turbidity		3	....
Solids, total		82	....
Loss on ignition		9	....
Mineral residue		73	....
Ammonia, free		.008	....
Ammonia, albuminoid		.108	....
Nitrites		Trace	....
Nitrates		Trace	....
Oxygen consumed		5.50	....
Chlorine		0.75	....
Hardness, total		22.10	....
Alkalinity		8.00	....
Bacteria per c.c.		275	20
B. coli type	10 c.c.	3+0—	2+1—
	1 c.c.	1+2—	0+3—
	1/10 c.c.	0+3—	0+3—

Results are expressed in parts per million. + Present. — Absent.
Abbreviations used to describe odors of water: 0, none; 1, very faint; 2, faint; 3, distinct; 4, decided; 5, strong; 6, very strong; a, aromatic; d, disagreeable; e, earthy; f, fishy; g, grassy; m, musty; v, vegetable.

HAMDEN

HERMANN M. BIGGS, M.D., *State Commissioner of Health:*

A reinspection of the public water supply of Hamden was made on June 22, 1915, by Dr. C. C. Duryee, sanitary supervisor of District "C." A previous investigation of this supply was made by the Engineering Division in 1908, a full report of which will be found on page 296, Vol. II, of the twenty-ninth annual report of this Department.

The public water supply of Hamden is derived from a reservoir located on Launt Hollow brook, about one mile north of the village. From this reservoir the water is distributed by gravity to the village. The description of this reservoir and the water works system in general remains practically the same as given in detail in the earlier report. The water works are owned and operated by Mr. Howard D. Youmans of Delhi, N. Y.

The watershed of Launt Hollow brook above the reservoir has a drainage area of about 4 square miles with a total population of about 50. The topography is rather steep and practically all the land is used for agricultural purposes.

At the time of the earlier inspection possible sources of contamination of the supply were found in eleven cases. These sources consisted of privies located either directly on the brook or within a very short distance from its banks. At the time of the reinspection by Dr. Duryee it was found that there had been apparently no abatement of any of the insanitary conditions upon the watershed.

In the earlier report it was recommended:

1. That immediate steps should be taken to remove all existing sources of pollution on the watershed of Launt Hallow brook tributary to the watershed and to guard against their recurrence in the future.

2. That in case Mr. Youmans should experience any difficulty in removing these sources of pollution, or otherwise find it impracticable to thus clean up this watershed and protect the supply obtained from it, to consider the question of applying to this Department for the enactment of rules and regulations for the protection of this supply.

It appears therefore from the report of Dr. Duryee that these recommendations have not been acted upon, although the need for them still exists.

The results of analyses of samples of this supply made in the past by the Division of Laboratories and Research will be found in the appended table.

These analyses show a soft water, somewhat colored and occasionally turbid. The water is somewhat high in decomposing and decomposable organic matter and at times the chlorine content is very much higher than normal for this region. The bacterial results are decidedly unsatisfactory, due to the very high counts and the occurrence of fecal organisms of the B. coli type in samples as small as 1/10 c. c.

In view of the above facts, the following conclusions may be drawn:

1. That the owner of this supply has carried out none of the recommendations of this Department.

2. That the insanitary conditions which still exist upon the watershed of the Hamden supply render it of decidedly unsatisfactory sanitary quality.

I would therefore recommend:

1. That Mr. Youmans give his immediate attention to the past recommendations of this Department.

2. That, in view of the always present possibility of accidental, incidental or wilful contamination upon a populated watershed, the supply be sterilized with liquid chlorine or a new supply of unquestionable sanitary quality be developed.

Respectfully submitted,

THEODORE HORTON,
Chief Engineer

ALBANY, N. Y., *November* 3, 1915

RESULTS OF WATER ANALYSES

Municipality	County	Source of sample	Date of collection	Physical				Chemical (Parts Per Million)											Bacteriological			
						Odor		Solids			Nitrogen as—						Hardness			B. Coli Type + = present — = absent		
				Color	Turbidity	Cold	Hot	Total	Loss on ignition	Mineral residue	Free ammonia	Albuminoid ammonia	Nitrites	Nitrates	Oxygen consumed	Chlorine	Total	Alkalinity	Bacteria per c.c.; gelatin 20°, 48 hours	10 c.c.	1 c.c.	1-10 c.c.
Hamden	Delaware	Tap, public supply	6/16/11	15	3	....	....	33	12	21	.004	.078	Tr.	0.40	3.20	3.75	15.6	3.0	900	+	+	+
Hamden	Delaware	Tap, public supply	10/30/11	5	Cl.	....	....	27	12	15	.024	.060	.001	0.30	1.70	0.75	14.3	12.0	750	+	+	—
Hamden	Delaware	Tap, public supply	1/29/12	Tr.	Tr.	....	....	38	6	32	.034	.038	Tr.	0.80	0.70	1.25	18.2	11.0	60	+	—	—
Hamden	Delaware	Tap, public supply	3/10/12	20	20	....	....	48	29	19	.050	.214	Tr.	0.36	4.70	1.25	14.3	6.0	33,000	+	+	+
Hamden	Delaware	Tap, public supply	4/12/12	10	5	....	....	21	6	15	.002	.038	.001	0.50	1.00	1.25	14.3	5.0	300	+	—	—
Hamden	Delaware	Tap, public supply	10/11/12	Tr.	Cl.	....	....	49	19	30	.006	.034	Tr.	0.10	1.10	1.00	26.0	20.0	200	+	—	—
Hamden	Delaware	Tap, public supply	11/15/12	5	Tr.	....	....	37	10	27	.016	.060	Tr.	0.50	0.30	0.75	22.1	9.0	750	+	+	—
Hamden	Delaware	Tap, public supply	1/ 3/13	5	Tr.	....	....	35	....	....	.014	.048	Tr.	0.68	1.50	1.25	14.3	8.0	275	+	—	—
Hamden	Delaware	Tap, public supply	2/ 7/13	5	2	....	....	36	....	....	.014	.044	Tr.	0.50	1.40	1.25	15.6	7.0	300	......	......	......
Hamden	Delaware	Tap, public supply	3/20/13	10	5	....	....	30	....	....	.014	.052	.001	0.50	1.50	0.75	11.1	6.0	9,300	+	—	—
Hamden	Delaware	Tap, public supply	4/24/13	2	3	....	....	32	....	....	.012	.052	Tr.	0.14	1.90	1.00	12.7	11.0	475	+	+	—
Hamden	Delaware	Tap, public supply	6/ 6/13	10	3	....	....	50	....	....	.004	.044	.001	0.04	2.10	0.25	12.7	12.0	1,600	+	+	—
Hamden	Delaware	Tap, public supply	7/ 7/13	3	2	....	....	53	....	....	.046	.038	Tr.	0.22	1.60	1.50	20.8	19.0	....	+	—	—
Hamden	Delaware	Tap, public supply	3/21/14	20	40	2 a.	2 a.	33	11	22	.048	.150	.001	0.40	3.90	1.00	11.1	3.0	6,200	3+0—	1+2—	0+3—
Hamden	Delaware	Tap, public supply	6/23/15	5	5	2 v.	2 v.	48	5	43	.002	.072	.001	0.02	3.10	1.00	28.6	23.0	1,700	3+0—	3+0—	1+2—
Hamden	Delaware	Tap, public supply	6/23/15	....	....	....	....	....	....	....	....	....	....	....	....	......	......	......	1,600	3+0—	3+0—	2+1—

HAMMONDSPORT

HERMANN M. BIGGS, M.D., *State Commissioner of Health:*

A reinspection of the public water supply of Hammondsport was made on October 8, 1914, by Dr. J. A. Conway, sanitary supervisor of District "K," and the following report is based largely upon information furnished by him. A previous investigation of this water supply was made by the Engineering Division in 1911, the full report of which will be found on page 734 of the thirty-second annual report of this Department.

The water supply of Hammondsport is derived from Keuka lake at a point near the western shore about one-half mile northeast of the village. The intake is 110 feet from the shore and in 35 feet of water. From this intake water is pumped to a standpipe and thence distributed by gravity. The population of the village is approximately 1,300 and the daily water consumption is 75,000 gallons. The water works system remains practically the same as described in detail in the former report and is owned and operated by the village.

At the time of the previous inspection certain conditions affecting the sanitary quality of the water supply were found, and the recent inspection disclosed the following facts in respect to improvements which have been made and to conditions which are still such as to require correction.

Glen brook, mentioned in the previous report, was dry at the time of the reinspection and a great deal of rubbish was found in the bed of the creek. Keuka inlet is also subject to pollution from surface wash, although it is stated that very much less manure is used by the vineyardists than in previous years. The cesspool used for the storage of excreta from the lake steamers has been reconstructed about 25 feet east of its former site and is claimed to be watertight. This cesspool is about 52 feet from the lake, but if frequently cleaned and care taken in the removal of the deposits there would probably be little contamination from this source. At the Bath and Hammondsport railroad engine shed there is a privy about 30 feet from the shore of the lake, and at the time of the inspection the privy vault was nearly full and in a filthy condition. Along the shores of the lake, particularly from the mouth of Glen brook to the Keuka inlet, a great deal of refuse, garbage and human excreta was observed. Underneath the Bath and Hammondsport railroad warehouse, which is partly used as a boathouse, conditions were especially filthy. A discharge of water containing organic matter below a house on the north side of the lake, as noted in the previous report, was not observed, and it is stated that this nuisance has been abated.

It was pointed out in the previous report that the water supply of the village might at times receive pollution from the sources already described because of the proximity of the intake to the shore and the action of winds and currents in the southern part of the lake. It was therefore recommended:

1. That the board of water commissioners take the necessary steps to have the pollution above referred to removed from this portion of the lake and its tributaries.

   (a) By preventing, so far as possible, the fertilizing of fields adjacent to all watercourses and by seeing that no manure used for fertilizing purposes is allowed to become contaminated by human excreta or other wastes.

   (b) By having the privies, cesspools, drains and other receptacles for human excreta or other wastes located a safe distance away from all streams, and that they be so constructed and maintained that no direct contamination from such sources can reach the water supply.

2. That the intake pipe be extended in an eastward direction to or near a point midway between the shores of the lake and in deep water.

3. That should any difficulty be experienced in abating conditions or carrying out the measures referred to the board of water commissioners apply to this Department for the enactment of rules and regulations

for the sanitary protection of the watershed of their supply in accordance with the provisions of section 70 of the Public Health Law.

4. That should the carrying out of the above measures be found inadequate to secure a supply of uniform purity, the question of the filtration of the supply be considered.

From the report of Dr. Conway, it appears that some action has been taken in one or two instances to limit the amount of contamination reaching the lake, but that little, if any, action has been taken toward carrying out the other recommendations of this Department.

At the time of his inspection samples of water were collected by Dr. Conway, and the results of the analyses of these, together with others made in the past three years by the Division of Laboratories and Research, will be found in the appended table.

These analyses show a water slightly colored, usually clear and moderately hard. The total numbers of bacteria are much higher than can be considered satisfactory for a potable water supply, and the occurrence of organisms of the B. coli type in 10 c. c. samples indicates occasional active contamination of animal or human origin.

It is evident that this supply cannot be considered as affording at all times a water of satisfactory sanitary quality. The opportunities for contamination of the waters of the lake by human excreta and other objectionable matter are numerous. Furthermore, there is a chance of contamination of water near the intake by sewage or excreta discharged from boats upon the lake, although this is a violation of the rules and regulations protecting the water supply of the village of Penn Yan, which is derived from this lake. Contamination brought about by any of the above described causes and under certain conditions of wind might be carried with considerable rapidity to the intake of the lake and thence into the water supply of the village.

In view of the above facts, the following conclusions may be drawn:

1. That recommendations of this Department have not been carried out by the village authorities, with the exception that improvements have been made of sanitary conditions around the shore in one or two instances.

2. That the water supply of Hammandsport is still open to serious contamination from surface wash from inhabited areas, excreta and other matters deposited on the shore of the lake and accidental or wilful contamination from boats or steamers plying upon the lake.

I would therefore recommend:

1. That the village authorities take immediate steps to safeguard the sanitary quality of their water supply by the following methods:

(a) Remove and prevent all contamination by human excreta of the shores of the lake.

(b) Install and carefully operate some modern method of sterilization by use of hypochlorite of lime or liquid chlorine.

Respectfully submitted,

THEODORE HORTON,
Chief Engineer

ALBANY, N. Y., *April* 21, 1915

RESULTS OF WATER ANALYSES

Abbreviations used to describe odors of water: 0, none; 1, very faint; 2, faint; 3, distinct; 4, decided; 5, strong; 6, very strong; a, aromatic; d, disagreeable; e, earthy; f, fishy; g, grassy; m, musty; v, vegetable.

Municipality	County	Source of sample	Date of collection	Physical				Chemical (Parts Per Million)											Bacteriological			
						Odor		Solids			Nitrogen as—						Hardness			B. Coli Type + = present — = absent		
				Color	Turbidity	Cold	Hot	Total	Loss on ignition	Mineral residue	Free ammonia	Albuminoid ammonia	Nitrites	Nitrates	Oxygen consumed	Chlorine	Total	Alkalinity	Bacteria per c.c.; gelatin 20°, 48 hours	10 c.c.	1 c.c.	1-10c.c.
Hammondsport	Steuben	Tap, public supply	9/16/11	5	Tr.	....	....	143	36	107	.012	.052	.001	0.20	1.40	3.25	80.0	77.0	......	......	......	......
Hammondsport	Steuben	Tap, public supply	1/ 8/12	....	Tr.	....	....	118	22	96	.024	.074	.001	0.20	1.00	3.50	87.1	75.0	30	+	—	—
Hammondsport	Steuben	Tap, public supply	2/14/12	Tr.	Cl.	....	....	113	22	91	.018	.084	Tr.	0.24	0.34	3.00	84.3	77.0	120	—	—	—
Hammondsport	Steuben	Tap, public supply	3/22/12	5	5	....	....	101	19	82	.016	.096	Tr.	0.20	2.40	2.50	74.3	69.0	6,000	+	—	—
Hammondsport	Steuben	Tap, public supply	6/21/12	5	Tr.	....	....	132	29	103	.004	.060	.001	0.20	1.50	3.25	80.0	75.0	20	—	—	—
Hammondsport	Steuben	Tap, public supply	10/ 7/12	10	Tr.	....	....	98	12	86	.004	.066	.002	0.06	1.80	2.75	77.1	75.0	1,200	—	—	—
Hammondsport	Steuben	Tap, public supply	11/25/12	Tr.	Cl.	....	....	115	11	104	.010	.084	Tr.	0.22	1.30	2.75	77.1	74.0	400	+	—	—
Hammondsport	Steuben	Tap, public supply	1/ 2/13	10	3	1 v.	1 v.	112	....	....	.010	.074	Tr.	0.24	1.30	4.00	85.7	73.0	*1,300	0+3—	0+3—	0+3
Hammondsport	Steuben	Tap, public supply	3/11/13	5	Tr.	1 v.	1 v.	111	....	....	.016	.058	Tr.	0.16	0.90	2.50	80.0	74.0	*2,000	0+3—	0+3—	0+3—
Hammondsport	Steuben	Tap, public supply	5/ 2/13	6	2	1 v.	1 v.	102	....	....	.004	.066	Tr.	0.14	1.20	3.00	84.3	69.0	3,800	0+3—	0+3—	0+3—
Hammondsport	Steuben	Tap, public supply	12/ 2/13	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	75	0+3—	0+3—	0+3—
Hammondsport	Steuben	Tap, public supply	12/ 2/13	Tr.	Tr.	2 v.	2 v.	120	27	93	.006	.052	.001	0.16	2.40	2.07	78.6	76.0	40	0+3—	0+3—	0+3—
Hammondsport	Steuben	Tap, public supply	10/ 8/14	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	275	1+2—	0+3—	0+3—
Hammondsport	Steuben	Tap, public supply	10/ 8/14	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	225	2+1—	1+2—	0+3—
Hammondsport	Steuben	Tap, public supply	10/ 8/14	Tr.	Cl.	1 v.	1 v.	144	34	110	.004	.060	.001	0.16	2.20	3.25	75.7	73.0	275	3+0—	0+3—	0+3—

* Two days in transit.

HAVERSTRAW

HERMANN M. BIGGS, M.D., *State Commissioner of Health:*

A reinspection of the public water supply furnished by the Haverstraw Water Supply Company to the villages of Haverstraw, West Haverstraw and Stony Point, in Rockland county, was made on September 23, 1914, by Dr. W. J. Denno, sanitary supervisor of District "F" and the following facts are based partly on data furnished by him and partly on information on file with this Department. A previous report of a full investigation of this supply made by the Engineering Division in 1909 will be found on page 304, volume 2 of the thirtieth annual report of this Department.

This water supply is derived from two sources, one by gravity from a reservoir supplied by a small stream and artesian wells near Thiells; and the other by pumping from a 4 million-gallon reservoir from Cedar Pond brook about three miles west of Haverstraw. The water works system remains practically the same as described in the previous report.

The Thiells supply is apparently satisfactory and reasonably free from sources of contamination. There are but four houses on the surface watershed and these are well back from the stream. The water of the stream and of the flowing wells is impounded in a 2½ million-gallon reservoir.

The Cedar Pond brook supply is open to serious contamination due to the fact that numerous houses are located within two miles upstream of the intake. The watershed is about 19 square miles in area and with the exception of that portion near the intake is practically uninhabited. Rules and regulations for the sanitary protection of the Cedar Pond brook supply were enacted by this Department on July 14, 1910.

At the head waters of this stream there is a tract of land upon which are located two comparatively large ponds. This tract of land has been leased by the water company for control of the storage. Recently the Palisades Interstate Park Commission has entered into an agreement for the purchase of this tract of land subject to the lease of the water company, it being the intention of the Commission to open this tract as a public park. As it is desired to use the ponds for boating and fishing, which operations are now prohibited by the rules and regulations enacted in 1910, the Park Commission requested this Department to so amend the rules as to allow boating, bathing and fishing upon these ponds. In view of the purchase by the Commission of the rights of the Haverstraw Water Supply Company in the waters of these ponds and brook the water company has agreed to install a filtration plant at a cost not to exceed $15,000 if required by this Department. The desired amendment was enacted April 2, 1915, allowing boating, bathing, fishing and ice cutting on watercourses beyond two miles up stream from the water works intake providing a modern filtration plant is in operation.

It is said that the sanitary conditions at the houses located within two miles of the intake have been somewhat improved since the previous inspection and numerous privies located near the stream have been removed. Notwithstanding such improvements, opportunities still exist for serious contamination not only from permanent sources but from accidental sources incidental to a well populated area.

The previous report pointed out that water of a satisfactory quality could be obtained from the Thiells supply if properly protected, but that the sanitary quality of the supply from Cedar Pond brook was open to question due to the probability of pollution from the inhabited area near the intake and it was recommended in this earlier report:

1. That a thorough inspection of the entire watershed of Cedar Pond brook above the intake should be made.
2. That steps should be taken to improve the quality of the supply either by removing all sources of pollution above the intake and taking steps to prevent further recurrence, or by avoiding this pollution by moving the intake up stream or beyond the settled area.

3. That, in case the water company experience any difficulty in removing sources of pollution from their watershed, they should consider the question of application to this Department for the enactment of rules and regulations for the protection of their supply.

According to Dr. Denno some steps have been taken by the water company to carry out recommendations 1 and 2, although no change has been made in the location of the intake. The enactment of rules and regulations by this Department was made in accordance with the third recommendation.

At the time of his inspection, Dr. Denno collected samples of water from both sources of supply and the results of the analyses of these samples together with others made in the past by the Division of Laboratories and Research will be found in the appended table.

These analyses show a water of moderate color, at times somewhat turbid and moderately hard. The total numbers of bacteria are practically always very high and organisms of the B. coli type are uniformly present in 10 c. c., frequently in 1 c. c. and often in 1/10 c. c., thus indicating considerable contamination of human or animal origin. A sample of the Thiells supply collected by Dr. Denno shows rather high bacteria and B. coli in 1 c. c. indicating that active contamination was reaching this supply at the time of the inspection.

In view of the above facts, the following conclusions may be drawn:

1. That the water company has acted along the lines of the recommendations of this Department in attempting to reduce the contamination of the Cedar Pond brook by the removal of sources of contamination, and by securing the enactment of rules and regulations by this Department, but that the water company has not extended the intake as advised.

2. That the supply is still open to serious and potentially dangerous contamination and in view of the opening of this region as a public park the danger of accidental contamination will become still greater in the future.

3. That the only adequate safeguard is undoubtedly some form of filtration supplemented by sterilization with hypochlorite of lime or liquid chlorine and the installation of a modern filtration plant should afford a satisfactory supply.

I would, therefore, recommend that the water company be requested to:

1. Continue their efforts to reduce the sources of contamination upon the watershed of the Cedar Pond brook supply and take active steps to prevent any contamination of the Thiells supply.

2. That in view of the recent amendment to the rules and regulations enacted by this Department in accordance with the agreement made in this connection as heretofore described a modern filtration plant be constructed and put in operation as soon as possible.

3. That, upon completion, this filtration plant be constantly and carefully operated.

Respectfully submitted,

THEODORE HORTON,

Chief Engineer

ALBANY, N. Y., *April* 19, 1915

RESULTS OF WATER ANALYSES

Abbreviations used to describe odors of water: 0, none; 1, very faint; 2, faint; 3, distinct; 4, decided; 5, strong; 6, very strong; a aromatic; d, disagreeable; e, earthy; f, fishy; g, grassy; m, musty; v, vegetable

Municipality	County	Source of sample	Date of collection	Physical				Chemical (Parts Per Million)											Bacteriological			
						Odor		Solids			Nitrogen as—						Hardness			B. Coli Type (+ = present, — = absent)		
				Color	Turbidity	Cold	Hot	Total	Loss on ignition	Mineral residue	Free ammonia	Albuminoid ammonia	Nitrites	Nitrates	Oxygen consumed	Chlorine	Total	Alkalinity	Bacteria per c.c.; gelatin 20°, 48 hours	10 c.c.	1 c.c.	1-10 c.c.
Haverstraw....	Rockland......	Tap, public supply..........	2/10/10	5	Cl.	....	....	84	28	56	.002	.002	....	0.10	2.30	2.00	50.0	......	550	—	—	—
Haverstraw....	Rockland......	Tap, public supply..........	7/ 8/10	1	5	....	....	62	22	40	.012	.044	.001	0.20	2.10	2.00	32.5	30.0	4,500	+	—	—
Haverstraw....	Rockland......	Tap, public supply..........	11/11/10	2	1	....	....	71	30	41	.010	.044	.002	0.20	1.20	3.75	35.8	32.0	750	+	+	+
Haverstraw....	Rockland......	Tap, public supply..........	1/ 6/11	20	Tr.	....	....	42	19	23	.008	.106	.002	0.10	2.50	2.63	19.5	11.0	5,000	+	+	—
Haverstraw....	Rockland......	Tap, public supply..........	3/21/11	18	15	....	....	94	41	53	.020	.092	.003	0.10	2.90	2.50	50.0	48.0	200	+	+	—
Haverstraw....	Rockland......	Tap, public supply..........	5/19/11	10	2	....	....	49	9	40	.023	.090	.001	0.10	2.80	2.00	20.8	16.0	160	+	+	+
Haverstraw....	Rockland......	Tap, public supply..........	6/29/11	10	5	....	....	72	15	59	.010	.036	.001	0.02	1.74	2.50	48.6	30.0	22,000	+	+	+
Haverstraw....	Rockland......	Tap, public supply..........	10/20/11	10	5	....	....	114	21	93	.012	.058	.001	0.10	1.25	2.50	60.0	45.0	1,200	+	+	+
Haverstraw....	Rockland......	Tap, public supply..........	12/13/11	5	Cl.	....	....	96	13	83	.010	.026	.001	0.14	0.52	2.25	51.3	51.0	300	+	—	—
Haverstraw....	Rockland......	Tap, public supply..........	1/23/12	15	Tr.	....	....	71	13	58	.023	.074	Tr.	0.30	5.00	2.12	36.4	30.0	1,600	+	+	—
Haverstraw....	Rockland......	Tap, public supply..........	2/28/12	15	10	....	....	58	18	40	.014	.060	.001	0.34	3.10	2.25	35.1	28.0	34,000	+	+	+
Haverstraw....	Rockland......	Tap, public supply..........	4/ 2/12	10	5	....	....	77	19	67	.008	.060	Tr.	0.36	2.40	1.50	35.1	30.0	300	+	—	—
Haverstraw....	Rockland......	Tap, public supply..........	10/ 3/12	10	Tr.	....	....	68	18	50	.004	.036	.001	0.12	2.10	2.50	40.3	25.0	3,100	+	—	—
Haverstraw....	Rockland......	Tap, public supply..........	11/ 7/12	10	Cl.	....	....	76	22	54	.014	.064	.001	0.20	2.90	2.50	36.4	32.0	......	+	—	—
Haverstraw....	Rockland......	Tap, public supply..........	12/27/12	5	Cl.	....	....	56	12	44	.020	.044	Tr.	0.20	2.20	2.50	33.8	24.0	80	+	—	—
Haverstraw....	Rockland......	Tap, public supply..........	1/27/13	10	3	1 v.	1 v.	53	....	....	.005	.048	.001	0.20	1.80	1.50	27.3	23.0	70	1+2—	0+3—	0+3—
Haverstraw....	Rockland......	Tap, public supply..........	3/10/13	2	3	1 v.	1 v.	63	....	....	.018	.064	Tr.	0.14	1.50	2.25	28.6	23.0	325	2+1—	0+3—	0+3—
Haverstraw....	Rockland......	Tap, public supply..........	4/14/13	7	5	1 v.	1 v.	82	....	....	.026	.062	.001	0.20	2.20	2.50	42.9	36.0	9,000	3+0—	2+1—	0+3—
Haverstraw....	Rockland......	Tap, public supply..........	5/23/13	25	7	1 v.	1 v.	69	....	....	.008	.082	.001	0.14	3.10	1.75	35.1	30.0	750	3+0—	3+0—	2+1—
Haverstraw....	Rockland......	Tap, public supply..........	7/ 7/13	10	2	1 a.	1 a.	80	....	....	.008	.056	.001	0.22	1.20	3.25	42.9	41.0	425	3+0—	1+2—	0+3—
Haverstraw....	Rockland......	Tap, public supply..........	3/23/14	18	Tr.	1 v.	1 v.	57	17	40	.008	.068	Tr.	0.16	3.40	2.25	29.9	26.0	5,800	3+0—	0+3—	0+3—
Haverstraw....	Rockland......	Cedar Brook reservoir......	9/23/14	12	2	1 v.	1 v.	74	20	54	.018	.052	.003	0.06	2.80	3.25	33.8	33.0	275	3+0—	2+1—	0+3—
Haverstraw....	Rockland......	Thiells reservoir............	9/23/14	5	3	1 v.	1 v.	128	25	103	.016	.028	.002	Tr.	1.60	2.63	67.1	65.0	425	3+0—	2+1—	0+3—
Haverstraw....	Rockland......	Tap, railroad station, mixed supply..................	9/23/14	....	....	....	....	....	....	....	....	....	....	....	....	......	......	......	2,300	3+0—	0+3—	0+3—
Haverstraw....	Rockland......	Tap, Cedar Brook supply....	9/23/14	....	....	....	....	....	....	....	....	....	....	....	....	......	......	......	5,150	—	1+2—	0+3—

HEMPSTEAD

HERMANN M. BIGGS, M.D., *State Commissioner of Health:*

An investigation of the public water supply of Hempstead, L. I., was made on September 30, 1915, by Mr. C. M. Baker, assistant engineer, in company with Dr. Frank Overton, sanitary supervisor of District "S".

Hempstead is an incorporated village in the town of Hempstead, Nassau county, on the main line (Hempstead Branch) of the Long Island railroad, about twenty-two miles from New York City. Its resident population is approximately 6,000 which, however, increases to about 7,000 during the summer months. The village is equipped with a complete system of sewers and an adequate disposal plant.

The water works, which consist of a pumping station, wells and a standpipe, are located in the northeastern edge of the village. Originally the water supply system was owned by a private company and the water works were constructed some twenty-five years ago. In 1901, however, the system was taken over by the village. Since then a new building has been constructed, a new boiler and one new pump provided and other general improvements made. About 85 or 90 per cent. of the population are served with the water. There are 1,500 service taps, only 20 of which are metered. The water consumption during the summer averages practically 600,000 gallons per day with a possible maximum of 1,500,000. The winter consumption averages about 400,000 gallons daily except in very cold weather when the consumption is practically the same as during the summer because the consumers allow the water to run from the faucets to prevent freezing of the water in the plumbing fixtures thus offsetting any decrease in quantity of water used in winter by reason of a lessened population. The average pressure is approximately 40 pounds per square inch.

The wells, eight in number, are 42 feet deep and are driven through strata of sand. They are provided with 12-inch tile casings which are perforated to within about 10 feet of the surface. Inside of this casing is a 6-inch suction line which is directly connected with the pumps. The casing extends to within about 6 feet of the surface where it terminates in a concrete well provided with a board cover. The pumping equipment consists of one Worthington pump with a capacity of 1,500,000 gallons daily and one Epping-Carpenter pump with a capacity of 2,000,000 gallons, which are operated by means of steam furnished by two 150-horse power boilers. The suction lift is approximately 8 feet. During pumping the surface of the water in the wells is lowered about 3½ feet. The standpipe is constructed of steel, is 20 feet in diameter by 100 feet high, and has a capacity of about 235,000 gallons. From the standpipe the water is conveyed to the consumers through approximately 30 miles of water mains ranging in size from 4 to 10 inches in diameter. There are, however, a few 2-inch branch lines.

The village owns between two and one-half and three acres of land about the plant. The plant itself, however, is located near the southern boundary of this plot. There are approximately ten houses within 500 feet of the wells and twenty between 500 to 1,000 feet distant. One house located south of the plant is provided with an insanitary privy only about 125 feet distant from one of the wells. A toilet at the plant is located about 25 feet from one of the wells and the sewage from it is conducted through tile pipe to the village sewer. A tile sewer of the village system is located in the center of the street about 150 feet west of the wells.

Samples of the water were collected and sent to the Division of Laboratories and Research for analyses the results of which are appended:

The results of the analyses show the presence of only a small amount of organic matter as indicated by the figures for free and albuminoid ammonia. The figures from nitrates, however, are somewhat high thus indicating organic contamination of the ground water sources which, however, has become well oxidized. The bacterial count is low and the B. coli type absent.

As a result of this investigation it is apparent:

1. That the quality of the water supply of Hempstead was satisfactory at the time of the investigation.
2. That there are two or three possible sources of pollution, namely, the privy south of the plant, the toilet at the plant and possibly the village sewer in the street.

In view of these facts, I beg to offer the following recommendations to be acted upon by the village authorities.

1. That the privy located near the plant be eliminated and the house connected with the village sewer system by means of a watertight cast iron sewer located as far as possible from the wells.
2. That the tile sewer leading from the toilet in the plant to the sewer system be abandoned and a watertight cast iron sewer provided in its stead.
3. That analyses of the water be occasionally made during the year to detect the presence of any active contamination which may occur either from the sewer in the street or other sources.
4. That should active contamination be at any time found present, steps be immediately taken to locate and eliminate the sources of pollution or to provide adequate purification of the water supply.

Respectfully submitted,

THEODORE HORTON,
Chief Engineer

ALBANY, N. Y., *December* 28, 1915

REPORT OF WATER ANALYSIS FOR HEMPSTEAD

Source		Tap, "D" sample	Tap, "A" sample
Collected on		....	9/30/15
Color		....	Trace
Odor, hot		....	1 v.
Odor, cold		....	1 v.
Turbidity		....	Clear
Solids, total		....	62
Loss on ignition		....	22
Mineral residue		....	40
Ammonia, free		....	.006
Ammonia, albuminoid		....	.004
Nitrites		....	Trace
Nitrates		....	1.00
Oxygen consumed		....	1.00
Chlorine		....	5.00
Hardness, total		....	19.50
Alkalinity		....	5.00
Bacteria per c.c.		20	20
B. coli type	10 c.c.	0+3—	0+3—
	1 c.c.	0+3—	0+3—
	1/10 c.c.	0+3—	0+3—

Results are expressed in parts per million. + Present. — Absent.
Abbreviations used to describe odors of water: 0, none; 1, very faint; 2, faint; 3, distinct; 4, decided; 5, strong; 6, very strong; a, aromatic; d, disagreeable; e, earthy; f, fishy; g, grassy; m, musty; v, vegetable.

HENSONVILLE

HERMANN M. BIGGS, M.D., *State Commissioner of Health:*

An investigation of the public water supply of the village of Hensonville was made by Mr. M. F. Sanborn, assistant engineer, on September 15, 1915. The inspector was assisted at the time of the inspection by Mr. E. M. Haney, president of the Water Company, Mr. B. T. Slater, secretary of the Company and Dr. S. L. Ford, supervisor of the town.

Hensonville is an unincorporated village in the southern part of the town of Windham, near the center of Greene county. It is about twenty miles from the Hudson river and about five miles from Hunter, which is the nearest railroad station on the U. & D. R. R. It is on Beaver kill, which is tributary to Schoharie creek. The population of the village at the time of the inspection was estimated at about 225.

The water supply of the village is furnished by the Hensonville Water Company and the water is used for household purposes and for fire protection. The water works were designed by Mr. E. Moxley, civil engineer, and were constructed under the direction of Mr. Moxley in 1903.

The water is obtained from five springs and a spring fed brook. The water from these springs and brook feed directly to the water mains leading to the village. A short distance below the springs a reservoir is located which has a by-pass leading from the mains to the reservoir and the surplus water fed to the mains overflows at the reservoir.

About 150 people or about two-thirds of the entire population are served by this supply. There are about 60 houses in the village of which 40 are connected with the water supply and 5 of these are metered. The water is distributed by gravity and the average pressure in the village is about 90 pounds. There are about 1¼ miles of water mains varying from 4 to 6 inches in size. Thirteen hydrants are placed in various parts of the village for fire protection. No definite figures on the daily water consumption could be obtained, but from figures of the minimum flow of the springs obtained some years ago it was estimated that the total consumption is about 13,000 gallons, which is equivalent to a per capita consumption of about 88 gallons.

The village has no sewer system or method of sewage disposal except local cesspools and septic tanks.

The springs are all located part way up the side of a hill and are about three-quarters of a mile east of the village. Three of the springs are at the foot of a steep slope and are well protected from surface wash since they are well covered and the sides are protected by stone walls which extend above ground. The other two springs are open and lie in a depression in the ground which at the time of the inspection was the bed of a small brook. All of the springs are protected by fences in order that cattle may not go within 50 to 100 feet of them. The springs located in the brook, however, receive surface water and the cattle had access to this brook above the springs. It was stated by officials of the company that when these springs were developed there was no water flowing in the brook.

The reservoir is an open earthen reservoir formed by the construction of an earth dam, with concrete core, across a small valley. The reservoir was estimated to be about 75 feet by 175 feet in plan and with an average depth of about 10 feet. This would give a capacity of about 1,000,000 gallons, which is equivalent to about 2½ months' consumption. The water in this reservoir was somewhat turbid and contained some cat-tails, frogs and water insects. This reservoir is used only as a storage reservoir and water is not ordinarily drawn from it unless the flow from the springs is insufficient to supply the requirements of the village. The reservoir is said to be cleaned each spring and the mains are flushed about twice a year.

The area of the watershed above these springs is comparatively small, although the area from which the water might be drawn may be as great as one-half square mile. The soil is generally of a sand and gravel character overlying bluestone and shale. There are no houses on the watershed above the springs and the only pollution which they might receive would be from hunters or from the cattle which have access to the brook above two of the springs.

At the time of the inspection samples of water were collected from a tap in the village and the results of the analyses are shown in the following table:

REPORT OF WATER ANALYSIS FOR HENSONVILLE

Source		Tap, public supply
Collected on		September 15, 1915
Color		Trace
Odor, hot		2, earthy
Odor, cold		2, earthy
Turbidity		Clear
Solids, total		60
Loss on ignition		25
Mineral residue		45
Ammonia, free		.004
Ammonia, albuminoid		.010
Nitrites		.001
Nitrates		0.16
Oxygen consumed		3.30
Chlorine		1.00
Hardness, total		14.30
Alkalinity		13.00
Bacteria per c.c.		1,200
	10 c.c.	Inoculations 3 + 0 —
B. coli type	1 c.c.	Inoculations 0 + 3 —
	1/10 c.c.	Inoculations 0 + 3 —

Results are expressed in parts per million. + Present. — Absent.
Abbreviations used to describe odors of water: 0, none; 1, very faint; 2, faint; 3, distinct; 4, decided; 5, strong; 6, very strong; a, aromatic; d, disagreeable; e, earthy; f, fishy; g, grassy; m, musty; v, vegetable.

From these analyses it is evident that the water was practically clear, without color, had a slight amount of odor and was very soft. The nitrogen in its various forms was comparatively low and showed a good water. The oxygen consumed, however, was a little high and showed the presence of carbonaceous organic matter. The number of bacteria was somewhat high and the presence of B. coli in 10 c. c. samples showed some pollution in the water which was evidently caused by the cattle pasturing above the springs.

As a result of this investigation and of the analyses the following conclusions may be drawn:

1. That the water supply of the village of Hensonville would be satisfactory in quality if the sources of pollution above the springs at its source were removed.
2. That the water in the reservoir was unsatisfactory from an esthetic standpoint.

In view of the above conclusions I would make the following recommendations:

1. That the two springs of the brook be abandoned and others developed out of reach of the brook water or that the entire brook feeding these springs be suitably fenced to keep the cattle away from the same.
2. That the reservoir be thoroughly cleaned each year, preferably during the early summer after the plant and insect life has started.

Respectfully submitted,

THEODORE HORTON,
Chief Engineer

ALBANY, N. Y., *October* 17, 1915

HILLBURN

HERMANN M. BIGGS, M.D., *State Commissioner of Health:*

A reinspection of the public water supply of Hillburn was made on October 27, 1914, by Dr. W. J. Denno, sanitary supervisor of District "F." A previous report on an investigation of this water supply made in 1912 by the engineering division will be found on page 680 of the thirty third annual report of this Department.

The water supply of this village is derived from two sources, one being an impounded surface supply from a watershed on the mountain three-quarters of a mile west of the village and the other being a driven well at the Ramapo

Iron Works in the northeastern part of the village. The water works are owned and operated by the Mountain Spring Water Company. According to Dr. Denno the condition of this water supply is exactly the same as at the time of the previous investigation. The earlier report pointed out the possibility of contamination of the upland supply from four houses located near a small stream tributary to the reservoir and also pointed out the possibility for contamination of the well water supply. In the earlier report the following recommendations were made:

1. That the direct pollution of the upland water supply be eliminated by the water company by
   (a) Removal of the buildings to a safe distance from those springs whose waters now enter the reservoir through the 12-inch pipe line or by the exclusion from the reservoir of this water.
   (b) Regular and frequent inspections of the whole watershed tributary to the reservoir to prevent unknown and accidental pollution of this part of the public supply.
2. That enough additional, safe and suitable upland water be secured from the village if possible, at reasonable expense, by the development of other mountain streams near the village to make the use of wells unnecessary.
3. That meanwhile thorough study be made by the water company of the present driven wells in order to ascertain if they are dangerously polluted and if any such pollution is due to sewers or other sources which could be corrected.
4. That the use of the well supplies be discontinued until on investigation it is shown that they can furnish a safe water at all times.

According to Dr. Denno none of these recommendations have been carried out.

At the time of his inspection Dr. Denno collected samples of water from the reservoir and from the wells at the Ramapo Iron Works. At this time there was very little water in the reservoir and the supply was being obtained from the well. The results of the analyses of these samples together with others made by the Division of Laboratories and Research since the previous inspection will be found in the appended table.

These analyses show a water as a rule rather high in color, practically clear and with rather high amounts of undecomposed organic matter of vegetable origin. The use of the well water probably tends to increase the amount of hardness present. The total number of bacteria have been high in several samples but these high numbers were probably due to their delay in reaching the laboratory. Organisms of the B. coli type have been present in 10 c. c. The samples collected by Dr. Denno were low in total bacteria and free from B. coli, indicating freedom from active contamination at the time the samples were collected.

In view of the above facts the following conclusions may be drawn:

1. That none of the recommendations of this Department have been carried out.
2. That the need for these recommendations probably still exists.

I would therefore recommend that the water company be requested to consider at once the recommendations of the previous report as set forth in detail above.

Although the analyses of the samples collected at the time of the reinspection show comparatively low bacterial counts and the absence of B. coli it should be noted that the supply was then being obtained from the well. A single set of analyses cannot determine what the sanitary quality of a ground water will be at all times and under all conditions. Furthermore, it is evident that the danger of contamination of the surface supply will continue to exist until unsatisfactory conditions on the watershed are remedied.

Respectfully submitted,
THEODORE HORTON,
Chief Engineer

ALBANY, N. Y., *March 16, 1915*

RESULTS OF WATER ANALYSES

Municipality	County	Source of sample	Date of collection	Physical: Color	Physical: Turbidity	Odor: Cold	Odor: Hot	Chemical (Parts per Million): Solids: Total	Solids: Loss on ignition	Solids: Mineral residue	Nitrogen as—: Free ammonia	Nitrogen as—: Albuminoid ammonia	Nitrogen as—: Nitrites	Nitrogen as—: Nitrates	Oxygen consumed	Chlorine	Hardness: Total	Hardness: Alkalinity	Bacteriological: Bacteria per c.c. gelatin 20°, 48 hours	B. Coli Type (+ = present, — = absent): 10 c.c.	B. Coli Type: 1 c.c.	B. Coli Type: 1-10 c.c.
Hillburn	Rockland	Tap, public supply	10/4/12	20	5	....	....	114	20	85	.006	.074	.001	0.24	4.70	4.50	50.0	25.0	500	+	+	—
Hillburn	Rockland	Tap, public supply	11/21/12	55	Tr.	....	....	65	18	47	.014	.112	Tr.	0.04	8.10	4.00	23.4	2.0	7,800	+	—	—
Hillburn	Rockland	Tap, public supply	12/31/12	35	Tr.	....	....	34	14	20	.014	.084	.001	Tr.	5.00	2.75	14.3	2.0	*21,000	+	—	—
Hillburn	Rockland	Tap, public supply	1/28/13	25	Tr.	1 v.	1 v.	29	....	....	.018	.072	Tr.	0.02	3.70	2.25	12.7	3.0	*21,000	2+1—	0+3—	0+3—
Hillburn	Rockland	Tap, public supply	3/10/13	25	Cl.	1 v.	1 v.	41	....	....	.010	.054	Tr.	0.04	3.90	2.50	7.9	2.0	*	....	....	....
Hillburn	Rockland	Tap, public supply	4/14/13	20	Cl.	1 a.	1 a.	35	....	....	.010	.056	Tr.	0.04	4.40	2.00	12.7	1.0	*1,000	1+2—	0+3—	0+3—
Hillburn	Rockland	Tap, public supply	5/26/13	65	Cl.	1 m.	1 m.	39	....	....	.012	.084	.001	0.04	9.00	2.25	19.5	4.0	*2,300	2+1—	0+3—	0+3—
Hillburn	Rockland	Reservoir at intake	10/27/14	Tr.	Cl.	1 v.	1 v.	111	33	78	.210	.020	.003	0.30	0.80	4.50	51.4	18.0	125	0+3—	0+3—	0+3—
Hillburn	Rockland	Well, Ramapo Iron Works	10/27/14	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	15	0+3—	0+3—	0+3—
Hillburn	Rockland	Tap	10/27/14	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	15	0+3—	0+3—	0+3—

* Delayed in transit.

HOMER

HERMANN M. BIGGS, M.D., *State Commissioner of Health:*

A reinspection of the public water supply of Homer was made on August 18, 1915, by Dr. Paul B. Brooks, sanitary supervisor of District "D." A previous investigation of this supply was made by the engineering division in 1912, a full report of which will be found on page 685 of the thirty-third annual report of this Department.

The public water supply of Homer is obtained from four driven wells located in the northwestern part of the village on the right bank of Factory creek. The source of water supply and the water works system in general remain the same as described in detail in the earlier report.

There are several houses within a comparatively short distance of these wells and a stock farm is located a little over one-quarter mile west of and above the pumping station. At the pumping station there is a large open well formerly used as a source of supply. Efforts are being made to fill it in by dumping ashes and other rubbish.

At the time of the earlier inspection the following conclusions were drawn in respect to the sanitary quality of this supply:

> 1. That the general sanitary conditions upon the watershed of the public water supply of the village of Homer are satisfactory and there are no indications that any direct or dangerous sources of pollution exist at the present time.
>
> 2. That the chemical character of the water is affected by the population and domestic animals resident on the watershed and that these effects are largely due to the large number of animals on the stock farm one-quarter of a mile above the wells.
>
> 3. That while the physical esthetic and sanitary qualities of this supply appear to have been satisfactory in the past it is important that the board of water commissioners of the village have complete control of the surroundings of the water supply wells for a radius of not less than 500 feet and that this area be put and maintained in an absolutely sanitary condition.

In view of these conclusions the following recommendations were made:

That the privy vaults of the houses southwest of the pumping station or any other privy vaults within a radius of 500 feet of the wells be removed or else be provided with removable water-tight containers and that the board of water commissioners maintain these in a strictly sanitary condition and cause the contents to be taken away to a safe distance and disposed of by burying or other approved means.

From the report of Dr. Brooks it appears that these recommendations with reference to providing houses near the water works with water-tight privy vaults have been carried out, concrete vaults having been constructed at the expense of the village and efforts are made to see that they are kept in a sanitary condition at all times.

At the time of his inspection Dr. Brooks collected samples of the water and the results of the analyses of these samples together with others made in the past by the Division of Laboratories and Research will be found in the appended table.

These results show a clear, colorless and hard water. The figures for nitrogen in its various forms and for oxygen consumed are low indicating the presence of moderate amounts only of decomposing and decomposable organic matter. The chlorine figures are somewhat higher than normal in this region but remain fairly constant over the series of analyses. The total bacterial counts are in most cases very low and the absence of organisms of the B. coli type indicates the absence of active contamination.

In view of the above facts the following conclusions may be drawn:

> 1. That the recommendations of this Department relative to the water supply have been carried out by the village authorities.

2. That the public water supply of Homer, although very hard is apparently of a satisfactory, sanitary and physical quality.

3. That the practice of dumping rubbish into the abandoned well in the vicinity of the wells now in use is a practice which might under certain conditions bring about organic contamination of the ground water supply tributary to the wells. I would, therefore, recommend:

1. That the village authorities continue a careful and constant oversight of their supply in order to maintain it in its present satisfactory condition.

2. That the abandoned well be filled in with clean gravel or other suitable material and the practice of dumping in rubbish be discontinued.

Respectfully submitted,

THEODORE HORTON,

Chief Engineer

ALBANY, N. Y., *November* 20, 1915.

Results of Water Analyses

Municipality	County	Source of sample	Date of col-l ction	Physical				Chemical (Parts Per Million)											Bacteriological			
						Odor		Solids			Nitrogen as—						Hardness			B. Coli Type + = present — = absent		
				Color	Turbidity	Cold	Hot	Total	Loss on ignition	Mineral residue	Free ammonia	Albuminoid ammonia	Nitrites	Nitrates	Oxygen consumed	Chlorine	Total	Alkalinity	Bacteria per c.c.; 20°, 48 hours	10 c.c.	1 c.c.	1-10 c.c.
Homer	Cortland	Tap, public supply	5/13/10	0	Cl.	....	....	145	15	130	.008	.012	.001	.040	0.35	0.75	117.2	117.0	16	—	—	—
Homer	Cortland	Tap, public supply	5/31/10	0	Cl.	....	....	141	15	126	.008	.012	.002	.060	0.50	1.00	117.2	117.0	8	—	—	—
Homer	Cortland	Tap, public supply	7/19/10	Tr.	Tr.	....	....	150	32	118	.014	.020	.001	.040	0.30	1.75	102.5	100.0	10	—	—	—
Homer	Cortland	Tap, public supply	9/ 7/10	Tr.	Cl.	....	....	168	56	112	.008	.016	.001	.020	0.10	1.00	108.6	105.0	10	—	—	—
Homer	Cortland	Tap, public supply	11/18/10	5	Cl.	....	....	151	16	135	.018	.024	Tr.	.024	0.10	1.50	134.2	130.0	5	—	—	—
Homer	Cortland	Tap, public supply	12/15/10	Tr.	Tr.	....	....	153	23	130	.004	.010	Tr.	.020	0.30	1.75	122.8	110.0	8	—	—	—
Homer	Cortland	Tap, public supply	2/28/11	Tr.	Tr.	....	....	167	40	127	.002	.024	Tr.	0.50	0.90	1.25	125.9	125.0	3	—	—	—
Homer	Cortland	Tap, public supply	6/12/11	5	Cl.	....	....	170	48	122	.014	.024	Tr.	0.30	0.30	1.75	114.2	113.0	600	—	—	—
Homer	Cortland	Tap, public supply	9/12/11	Tr.	Cl.	....	....	157	16	141	.010	.014	.001	0.50	0.60	2.00	128.6	128.0	80	—	—	—
Homer	Cortland	Tap, public supply	11/15/11	Tr.	Cl.	....	....	183	16	167	.016	.030	.002	0.40	0.20	2.50	157.2	142.0	60	+	—	—
Homer	Cortland	Tap, public supply	12/28/11	Tr.	Cl.	....	....	159	17	142	.008	.008	.001	0.60	0.10	2.50	140.0	140.0	20	—	—	—
Homer	Cortland	Tap, public supply	2/ 8/12	Tr.	Cl.	....	....	155	15	140	.020	.026	Tr.	0.90	0.10	1.87	137.2	136.0	10	—	—	—
Homer	Cortland	Tap, public supply	3/18/12	Tr.	Cl.	....	....	166	24	142	.010	.016	Tr.	1.02	0.40	1.50	137.2	131.0	10	—	—	—
Homer	Cortland	Tap, public supply	4/29/12	Tr.	Cl.	....	....	149	18	131	.010	.020	Tr.	0.80	0.10	1.25	131.2	124.0	190	—	—	—
Homer	Cortland	Tap, public supply	9/25/12	Tr.	Cl.	....	....	182	44	138	.004	.016	Tr.	0.60	0.20	1.75	131.4	......	190	—	—	—
Homer	Cortland	Tap, public supply	10/30/12	Tr.	Cl.	....	....	168	23	145	.012	.014	Tr.	0.50	0.30	1.50	145.8	143.0	10	—	—	—
Homer	Cortland	Tap, public supply	11/29/12	Tr.	Tr.	....	....	171	20	151	.028	.020	Tr.	0.70	0.90	2.00	145.8	143.0	50	—	—	—
Homer	Cortland	Tap, public supply	12/28/12	Tr.	Cl.	....	....	170	12	158	.020	.020	.001	0.60	0.80	1.75	151.4	150.0	20	—	—	—
Homer	Cortland	Tap, public supply	2/ 5/13	Tr.	Cl.	....	....	172	....	....	.010	.018	Tr.	0.70	0.40	1.50	145.8	143.0	10	—	—	—
Homer	Cortland	Tap, public supply	3/19/13	Tr.	Cl.	....	....	173	....	....	.012	.014	Tr.	0.70	0.30	2.00	140.0	138.0	5	—	—	—
Homer	Cortland	Tap, public supply	5/14/13	Tr.	Cl.	....	....	160	....	....	.004	.014	Tr.	0.66	0.40	1.75	131.7	129.0	30	—	—	—
Homer	Cortland	Tap, public supply	6/18/13	Tr.	Cl.	....	....	160	....	....	.004	.004	Tr.	0.50	0.30	2.00	131.4	128.0	50	—	—	—
Homer	Cortland	Tap, public supply	7/23/13	Tr.	Cl.	....	....	156	....	....	.004	.004	Tr.	0.66	0.40	2.00	137.2	131.0	30	—	—	—
Homer	Cortland	Tap, public supply	4/28/14	Tr.	Tr.	1 v.	1 v.	160	20	140	.014	.032	.001	0.80	0.90	1.75	137.2	132.0	5	—	—	—
Homer	Cortland	Tap, public supply	8/18/15	Tr.	Cl.	1 v.	1 v.	306	95	211	Tr.	Tr.	.002	2.00	0.10	2.25	148.6	140.0	80	—	—	—

HONEOYE FALLS

HERMANN M. BIGGS, M.D., *State Commissioner of Health:*

An investigation of the public water supply of Honeoye Falls was made by Mr. C. M. Baker, assistant engineer, on September 9, 1915.

Honeoye Falls is an incorporated village of about 1,300 inhabitants located in the town of Mendon, Monroe county, on the Rochester branch of the Lehigh Valley railroad. It is about fifteen miles south of Rochester and on Honeoye creek, a tributary to the Genesee river.

The water supply is owned by the municipality and consists of two driven wells located in the center of the village from which water is pumped into an elevated tank located directly over the wells whence it flows by gravity under a pressure of about 55 pounds per square inch through the mains to the consumers. About 30 per cent. of the population are served with the water. There is a total of 110 service taps, all of which are metered. The average consumption is approximately 12,000 gallons daily. The water works were installed in 1913.

One well is 6 inches in diameter by 100 feet deep and the other 8 inches in diameter by 190 feet deep. The strata through which the wells are driven consists of 4 or 5 feet of surface soil, 35 to 40 feet of corniferous limestone, and the remainder of the distance of a softer limestone. Directly over the wells is located the pumping plant, the pumps of which are 23 feet below the surface in a pump well and draw the water from a sump or suction well about 46 feet deep. The water rises naturally in this sump or suction well except at times of extreme drought. The larger well is, however, equipped with an air lift device by means of which the water is lifted into the sump at such times. The capacity of this air lift is given as 500 gallons per minute. The pumps are operated by two gas engines of 22 horse power each and consist of two Rumsey triplex pumps each with a capacity of 250 gallons per minute.

The elevated water tank is constructed of steel and is located on a tower directly over the pumping station. The bottom of the tank is 90 feet above the elevation of the ground and the height of the tank is 30 feet. Its capacity is 125,000 gallons. The water mains consist of 6 miles of pipe, most of which range from 6 to 8 inches in diameter, there being, however, a small amount of 4-inch pipe.

The wells are located in the center of the village block which is entirely built up, the space occupied by the plant being not over 40 feet square. There is a population of about 100 people within 500 feet of the plant, which corresponds to a density of population equivalent to 3,700 per square mile. Beyond the 500-foot radius and within 1,000 feet of the wells about the same density of population exists, so that within this area there are some 300 people, thus making a total of 400 people within 1,000 feet of the plant. This population is distributed quite uniformly over the area and the contour of the ground is such that it is probable the ground water from which the supply is derived receives pollution from approximately one-half of this population. The extent to which the polluted ground water from this area will become purified during its passage through the soil depends on the character of the soil, velocity of the ground water flow and various other hydraulic conditions.

The most serious sources of contamination in the immediate vicinity of the plant consist of

1. A privy not provided with a vault, located about 90 feet distant, which was in a very insanitary condition at the time of the inspection.
2. Two hotel privies not equipped with vaults and in an insanitary condition located about 75 feet distant.
3. A barn and garbage dump 50 feet distant with the barnyard extending to within 5 feet of the plant.
4. A hotel barn 75 feet distant with a barnyard extending to within 10 feet of the plant.

Samples of water were collected and sent to the Division of Laboratories and Research for analyses, the results of which are as follows:

REPORT OF WATER ANALYSIS FOR HONEOYE FALLS

Source		Tap in village	Tap in village	Tap at pump station
Collected on		9/9/15	....	....
Color		Trace	....	....
Odor, hot		1v	....	....
Odor, cold		1v	....	....
Turbidity		Trace	....	....
Solids, total		788	....	....
Loss on ignition		160	....	....
Mineral residue		678	....	....
Ammonia, free		.002	....	....
Ammonia, albuminoid		.004	....	....
Nitrites		.001	....	....
Nitrates		0.40	....	....
Oxygen consumed		2.80	....	....
Chlorine		8.25	....	....
Hardness, total		407.0	....	....
Alkalinity		225.0	....	....
Bacteria per c.c.		35	15	40
B. coli type	10 c.c.	0+3—	0+3—	1+2—
	1 c.c.	0+3—	0+3—	0+3—
	1/10 c.c.	0+3—	0+3—	0+3—

The results of the analyses indicate that the water is satisfactory in appearance but that it is exceedingly hard, the total hardness being 407.0 parts per million when expressed in terms of calcium carbonate.

Regarding the sanitary quality of the water, there was present only a small amount of unoxidized organic matter as is shown by the figures for free and albuminoid ammonia, but considerable oxidized organic matter was present as is indicated by the presence of nitrates. While it is possible that the high chlorine content is due in part to saline deposits in the vicinity it is probable that it is due also to the insanitary conditions which exist in the vicinity of the wells, and, therefore, that the organic matter present is derived from barnyards, privies, cesspools and other similar sources. The bacterial analyses show the presence of from 15 to 40 bacteria per c. c. with the B. coli type present in only 1 of the 9, 10 c. c. inoculations tested.

Summarizing the analyses it is apparent that some pollution is finding its way into the ground water from which the supply is derived but that the water had become well purified in its passage through the soil and therefore practically no active contamination was present at the time of inspection. It is impossible, however, to judge from a single analysis whether this pollution might not become active at other times and under other conditions, since under different hydraulic conditions of the ground water, which might exist at other seasons of the year, the ground water flow and conditions may be such as to carry pollution and possibly infection from some of the numerous sources existing in the vicinity of the wells, more directly and insufficiently purified into the wells.

As a result of this investigation I would conclude:

1. That the wells from which the water supply for Honeoye Falls is derived are unfortunately located in the center of a comparatively dense population with insanitary methods of sewage disposal and other insanitary conditions in their immediate vicinity which probably cause contamination of the water supply under certain conditions.

2. That, although the analyses of samples of the water collected at the time of the investigation show little active contamination, it is possible that samples collected at another time, when the conditions of ground water flow are different, would show active and possibly dangerous pollution.

In view of the above I beg to offer the following recommendations to be acted upon by the village authorities for the purpose of improving the quality of the supply.

1. That the village acquire more land surrounding the plant, and that all sources of pollution be eliminated from the area.
2. That all cesspools be made watertight and all privies provided with watertight containers within 500 feet of the wells, and that the contents be removed from these containers and disposed of in some remote place in a sanitary manner at frequent intervals in order that they may at all times be maintained in a satisfactory, sanitary condition.
3. That regular analyses of the water be made at different seasons during the year to detect any presence of active contamination.
4. That, should such contamination be found present at any time,
   (a) Steps be immediately taken to determine and eliminate the sources of the pollution, or
   (b) If this is impossible or impracticable, the supply be sterilized by liquid chlorine or otherwise purified.
   (c) In lieu of the above or in case the above improvements seem impracticable or do not bring about the desired results, a new supply properly protected and removed from all sources of pollution be developed.

Respectfully submitted,
THEODORE HORTON,
Chief Engineer

ALBANY, N. Y., *October* 23, 1915

ITHACA

HERMANN M. BIGGS, M.D., *State Commissioner of Health:*

A reinspection of the public water supply of Ithaca was made on January 21, 1915, by Dr. H. H. Crum, sanitary supervisor of District "R." Descriptions of this water supply will be found in reports published in the thirtieth annual report of this Department, volume 2, pages 402 and 771 respectively.

The public water supply of Ithaca is derived from Six Mile creek, the waters of which are impounded in a large storage reservoir with a capacity of 350,000,000 gallons, located at Potters Falls about two miles southeast of the city. From this reservoir the water is conducted by gravity to the filtration plant located in the outskirts of the city. After filtration the water is distributed through the city by pumping and partly by gravity.

The purification plant consists of two covered coagulation basins arranged in parallel, six rapid sand filters, gravity type, each with a capacity of 500,000 gallons daily, apparatus for sterilization of the filtered water with hypochlorite and a covered pure water basin. The sterilization plant was added to the system in April, 1914.

The installation of the purification plant followed an epidemic of typhoid in Ithaca in 1903. This epidemic, one of the largest and most disastrous of any that has ever occurred in this State, was traced to infection of the unpurified Six Mile creek water supply.

The watershed of Six Mile creek above the reservoir is approximately 45.3 square miles, and the population thereon may be estimated at 2,260, or 50 per square mile. The greater part of this population is scattered along the numerous highways which traverse the area. There are, however, two villages, Brookton and Slaterville, the drainage of which goes into the creek. The other houses with accompanying outbuildings also contribute more or less direct contamination to the supply.

Rules and regulations for the sanitary protection of the water supply of Ithaca were enacted by this Department in 1903. In 1914 an inspection of the watershed was made under the direction of Prof. H. N. Ogden, and at

that time a general disregard of the rules was found to exist. Upon this inspection 90 actual and 30 possible sources of pollution were noted. No information has been received as to the action taken by the local authorities toward abating these conditions.

At times of heavy rainfall and melting snow marked changes occur in the turbidity and alkalinity of the raw water. These sudden changes make the proper operation of the purification plant extremely difficult. At present the plant is operated by three men, each on an eight-hour shift. One of these men supervises the operation of the plant and has had limited instruction and training in its operation. He is not, however, a technically trained man and has not had extended experience.

The previous reports upon this supply have emphasized the necessity and importance of constant, careful operation, and while it is evident that this necessity has been appreciated to some extent by the city authorities it is also evident from the report of Dr. Crum that the supervision of the plant is not as thorough as should be maintained, especially in the light of the changeable and dangerous character of the raw water which has to be dealt with. In this connection it should be noted that the typhoid fever death rate in Ithaca for the year 1914 was 25.9 compared with a rate of 8.8 for the State at large.

At the time of his inspection Dr. Crum collected samples of water at various stages in the purification process and the result of the analyses of these samples together with others made in the past by the Division of Laboratories and Research will be found in the appended table.

These analyses show clearly the contaminated condition of the raw water and its unfitness as a potable supply without purification. Analyses of the filtered water as a rule show satisfactory reductions in total numbers of bacteria and almost complete elimination of organisms of the B. coli type. At times, however, the total counts in the filtered water are very high and organisms of the B. coli type have been present, indicating that satisfactory purification is not obtained at all times.

In view of the above facts the following conclusions may be drawn:

1. That the filtration plant for the Ithaca water supply is properly designed and is capable of producing an effluent of satisfactory sanitary quality if properly operated and supervised at all times.
2. That this proper supervision and control are obtained under all conditions is open to some doubt due to the limited training and experience of the operator in charge of the filter.
3. That the city authorities have apparently been lax in the enforcement of the rules and regulations enacted by this Department for the sanitary protection of their water supply.

I would therefore recommend:

1. That the city authorities maintain at all times constant and careful supervision and control of the filtration plant. In this connection it would be well to retain the services of a consulting expert who would make frequent inspections and who would be available at all times for technical advice.
2. That in view of the superiority of liquid chlorine as a sterilization agent, apparatus for its application to the filtered water be installed to replace the present apparatus for applying hypochlorite.
3. That the city authorities thoroughly enforce the rules and regulations enacted by this Department for the sanitary protection of their supply.

Respectfully submitted,

THEODORE HORTON,

Chief Engineer

ALBANY, N. Y., *September* 3, 1915

RESULTS OF WATER ANALYSES

Municipality	County	Source of sample	Date of collection	Physical				Chemical (Parts Per Million)												Bacteriological			
						Odor		Solids			Nitrogen as—						Hardness				B. Coli Type + = present — = absent		
				Color	Turbidity	Cold	Hot	Total	Loss on ignition	Mineral residue	Free ammonia	Albuminoid ammonia	Nitrites	Nitrates	Oxygen consumed	Chlorine	Total	Alkalinity	Bacteria per c.c.; gelatin 20°, 48 hours		10 c.c.	1 c.c.	1-10 c.c.
Ithaca	Tompkins	Tap, public supply	2/25/10	Tr.	Tr.			145	13	132	.002	.016	.002	0.68	1.39	2.00	80.6		120		—	—	—
Ithaca	Tompkins	Tap, public supply	1/ 9/11																275		+	—	—
Ithaca	Tompkins	Tap, public supply	1/12/11																200		+	—	—
Ithaca	Tompkins	Tap, public supply	2/14/11	Tr.	Cl.			119	32	87	.026	.022	Tr.	0.60	0.60	2.75	77.1	60.0	80		—	—	—
Ithaca	Tompkins	Raw water	2/18/11																24,000		+	+	+
Ithaca	Tompkins	Effluent, filter No. 1	2/18/11																1,800		+	—	—
Ithaca	Tompkins	Tap, public supply	2/18/11																37		—	—	—
Ithaca	Tompkins	Tap, public supply	2/18/11																1,900		+	—	—
Ithaca	Tompkins	Raw water	4/ 3/11																6,000		+	+	—
Ithaca	Tompkins	Filtered water	4/ 3/11																120		—	—	—
Ithaca	Tompkins	Raw water	4/20/14																11,000		3+0—	1+2—	0+3—
Ithaca	Tompkins	Coagulated water	4/20/14																275		1+2—	0+3—	0+3—
Ithaca	Tompkins	Effluent, filter No. 2	4/20/14																35		2+2—	0+4—	0+4—
Ithaca	Tompkins	Sterilized reservoir water	4/20/14																10		0+4—	0+4—	0+4—
Ithaca	Tompkins	Raw water	1/21/15	30	360	1 v.	1 v.	172	18	154	.036	.110	.036	0.20	5.40	1.50	47.1	46.0	7,400		3+0—	3+0—	0+3—
Ithaca	Tompkins	Coagulated and settled water	1/21/15	Tr.	10	1 v.	1 v.	59	10	49	.036	.090	.001	0.40	2.50	1.50	48.6	29.0	450		2+1—	0+3—	0+3—
Ithaca	Tompkins	Filtered and settled water	1/21/15	Tr.	3	1 v.	1 v.	62	11	51	.022	.078	.001	0.60	1.60	1.75	47.1	26.0	35		0+3—	0+3—	0+3—
Ithaca	Tompkins	Tap, public supply	1/21/15																15		0+3—	0+3—	0+3—
Ithaca	Tompkins	Raw water	4/20/15																250		3+0—	0+3—	0+3—
Ithaca	Tompkins	Coagulated water	4/20/15																60		3+0—	0+3—	0+3—
Ithaca	Tompkins	Filtered	4/20/15																14		0+3—	0+3—	0+3—

JAMESTOWN

HERMANN M. BIGGS, M.D., *State Commissioner of Health:*

A reinspection of the public water supply of Jamestown was made on July 26, 1915, by Dr. J. J. Mahoney, sanitary supervisor of District "M." A previous investigation of this supply was made by Professor H. N. Ogden in connection with his investigation in 1912 of the sanitary conditions of this city. The report of Professor Ogden will be found on page 916 of the thirty-third annual report of this Department.

The water supply of Jamestown is derived from 15 driven wells located about 2 miles northeast of the city in the low lying meadow adjacent to Cassadaga creek near its junction with the Chadakoin river. These wells are of 8-inch pipe driven to a depth of 95 feet through an impervious stratum of clay into water bearing gravel. The wells are connected and discharge through a 24-inch main into a circular well 40 feet deep. From this well the water is pumped through two 16-inch mains to a reservoir on English Hill which has a capacity of 5,000,000 gallons. There are about 8,100 service taps in the city, of which 6,700 are metered. In addition to the city itself the villages of Falconer, Celeron, Levant and Lyndon are supplied. The total population served is estimated at 40,000 and the per capita daily consumption for 1914 was 60 gallons. The water works are owned and operated by the city.

The location of the wells is such that it seems probable that the principal opportunity for contamination of the supply would occur during the flooding of land around the wells by the creek or river at times of high water. The report of Professor Ogden pointed out this possibility and recommended that the board of water commissioners take steps to determine whether the quality of the water was affected by floods in the river. This earlier report also mentioned the possibility of contamination by the use of fire pumps in the factories.

At the time of his inspection Dr. Mahoney collected samples of water of this supply and the results of the analyses of these samples together with others made in the past by the division of laboratories and research will be found in the appended table.

These analyses show a uniformly clear and cororless water although very hard. The figures for nitrogen in its various forms are low and indicate the absence of decomposing and decomposable organic matter. The bacterial counts are in most cases moderate although occasionally the counts are higher than should be found in an unpurified ground water supply and these results may possibly be due to multiplication of the bacteria in transit before reaching the laboratory. In only one of the samples were organisms of the B. coli type found and this in a 10 c. c. inoculation only. This particular sample was one which was delayed in reaching the laboratory.

In view of the above facts the following conclusions may be drawn:

1. That the public water supply of the city of Jamestown is apparently of a reasonably satisfactory sanitary and esthetic quality.

2. That the flooding of land in the vicinity of the wells from which the supply is derived renders possible incidental contamination of the supply by seepage along the casing of the wells or through channels or perforation through the clay strata above the water-bearing gravel.

In view of the above conclusions the following recommendations may be made:

1. That the city authorities continue a careful oversight of the sanitary condition of their water supply especially at times of flooding of the meadows in which the wells are located.

2. That the city have made regular and frequent analyses of this supply in order to detect any active contamination which may occur

and in case of such occurrence that immediate steps may be taken for the detention and removal of such sources of contamination. If, however, it is found impossible or impracticable to detect or abate such sources of contamination, it would be advisable for the city authorities to consider the sterilization of the supply with liquid chlorine.

Respectfully submitted,

THEODORE HORTON,
Chief Engineer

ALBANY, N. Y., *October* 26, 1915

RESULTS OF WATER ANALYSES

Abbreviations used to describe odors of water: 0, none; 1, very faint; 2, faint; 3, distinct; 4, decided; 5, strong; 6, very strong; a, aromatic; d, disagreeable; e, earthy; f, fishy; g, grassy; m, musty; v, vegetable

Municipality	County	Source of sample	Date of collection	Physical				Chemical (Parts per Million)											Bacteriological			
						Odor		Solids			Nitrogen as—						Hardness			B. Coli Type + = present − = absent		
				Color	Turbidity	Cold	Hot	Total	Loss on ignition	Mineral residue	Free ammonia	Albuminoid ammonia	Nitrites	Nitrates	Oxygen consumed	Chlorine	Total	Alkalinity	Bacteria per c.c.; gelatin 20°, 48 hours	10 c.c.	1 c.c.	1-10 c.c.
Jamestown....	Chautauqua...	Tap, public supply..........	4/15/12	Tr.	Cl.	....	....	119	14	105	.008	.004	.004	Tr.	Tr.	2.50	91.4	85.0	10	−	−	−
Jamestown....	Chautauqua...	Tap, public supply..........	9/23/12	Tr.	Cl.	....	....	127	13	112	.002	.006	.001	Tr.	0.30	2.50	100.0	81.0	33,500	−	−	−
Jamestown....	Chautauqua...	Tap, public supply..........	11/ 9/12	Tr.	Cl.	....	....	128	19	109	.020	.022	.002	0.04	1.00	3.25	90.0	83.0	130	−	−	−
Jamestown....	Chautauqua...	Tap, public supply..........	12/13/12	Tr.	Cl.	....	....	117	11	106	.010	.022	.001	Tr.	0.70	2.50	85.8	84.0	80	−	−	−
Jamestown....	Chautauqua...	Tap, public supply..........	1/23/13	Tr.	Cl.	....	....	117	....	....	.004	.034	.001	0.02	0.50	2.50	84.3	81.0	10	−	−	−
Jamestown....	Chautauqua...	Tap, public supply..........	2/20/13	Tr.	Cl.	....	....	140	....	....	.008	.014	Tr.	0.02	0.70	3.25	85.7	84.0	10	−	−	−
Jamestown....	Chautauqua...	Tap, public supply..........	4/ 3/13	Tr.	Cl.	....	....	130	....	....	.010	.012	Tr.	0.02	0.40	2.50	98.6	83.0	10	−	−	−
Jamestown....	Chautauqua...	Tap, public supply..........	5/21/13	Tr.	Cl.	....	....	134	....	....	.008	.006	Tr.	0.02	0.10	2.00	85.8	83.0	180	−	−	−
Jamestown....	Chautauqua...	Tap, public supply..........	7/11/13	Tr.	Cl.	....	....	139	....	....	.004	.004	.001	0.02	0.20	2.75	85.7	85.0	*	+	−	−
Jamestown....	Chautauqua...	Tap, public supply..........	4/15/14	Tr.	Tr.	1 v.	1 v.	120	25	95	.012	.020	.001	0.02	0.50	2.75	85.7	84.0	10	−	−	−
Jamestown....	Chautauqua...	Tap, public supply..........	7/26/15	Tr.	Cl.	1 v.	1 v.	148	58	90	.004	.002	.001	0.02	0.30	3.75	81.4	80.0	80	−	−	−

* Results vitiated by multiplication in transit.

JAY

HERMANN M. BIGGS, M.D., *State Commissioner of Health:*

A reinspection of the public water supply of Jay was made October 20, 1914, by Dr. J. A. Smith, sanitary supervisor of District "A," and the following report is based largely upon information furnished by him. A full report on a previous investigation of this supply made by the engineering division in 1912 will be found on page 693 of the thirty-third annual report of this Department.

The public water supply of Jay is derived by gravity from a mountain stream known as Rocky Branch, the intake being about three miles south of the village. The source of the supply and the water works system in general remain practically the same as described in detail in the earlier report except that the old wooden dam forming the intake reservoir has been repaired by the addition of about 30 feet of concrete dam, forming a 30-foot concrete spillway. Deposits of sand and gravel washed into the reservoir have also been partly cleared away by digging out all material easily removable.

The watershed above the reservoir is approximately 8.5 square miles in area, consisting mainly of the steep side slopes of Jay mountain. The resident population on this area at the time of the reinspection was approximately 24 or about 3 per square mile. During the winter at the time of lumbering operations this population is increased to about 40. Within a year or two, however, it is expected that the lumber will be completely cut off and that the watershed will become uninhabited.

At the time of the reinspection the following conditions having sanitary significance were found by Dr. Smith: About two miles above the reservoir is the first habitation on the watershed and at this place there is a privy in an insanitary condition within 75 feet of the stream. Farther up the brook at an unoccupied house there was evidence that garbage and refuse had been thrown upon the ground sloping sharply toward the stream. About 3¾ miles farther up the mountain is the Senecal camp of the J. & J. Rogers Company. At this camp there is one family and the privy is located about 50 feet from and on a slope toward the stream. There are also numerous barns and outbuildings connected with the camp. Four miles above the reservoir at the top of Jay mountain is the Pelkey camp of the Rogers Company, consisting of two habitations containing four families and having two privies located some 300 feet from the stream. The privies at both these camps were of the ordinary dirt vault type. There were several pig pens and other outbuildings in connection with this camp and the slope of the ground was from all these buildings toward the stream.

The earlier report pointed out that, while as a rule the water supply of this village was of a reasonably satisfactory quality, at certain times of the year considerable objectionable turbidity was present in the water which would not be removed by sedimentation in the small reservoir. It was further pointed out that although the sanitary quality was at most times fairly satisfactory, there were times when its safety was menaced by the population engaged in work upon the various parts of the watershed.

It was therefore recommended:

1. That the board of water commissioners have regular and frequent inspections made of the whole watershed of Rocky Branch above the intake dam to apprise themselves of and abate any direct and permanent pollution of the stream or tributaries by any careless or wilful pollution.
2. That all lumbering and other operations upon the watershed above the water works intake be forbidden except under the strict supervision of the board of water commissioners and in such manner as would prevent any dangerous pollution of the water and that, if necessary or desirable, the board apply to this Department for the enactment of rules and regulations for the sanitary protection of the public water supply.

3. That the board of water commissioners of the village increase the reservoir capacity of the water works, preferably by the construction of a distributing reservoir to be of such capacity and having such location as to provide storage for sedimentation and pressure and a reserve capacity for fire protection.

From the report of Dr. Smith it would appear that little or no attempt has been made by the village authorities to carry out these recommendations.

At the time of his inspection Dr. Smith collected samples from the supply and at several points along the stream above the reservoir and the analyses of these samples together with others made in the past by the Division of Laboratories and Research will be found in the appended table. The analyses are too few in number to determine the quality of the water at all times and under all conditions. These analyses showed a water somewhat colored, moderately hard and clear. These samples were taken at times when the run-off was moderate and do not show the turbidity which is undoubtedly present at times of heavy rainfall. The total numbers of bacteria are very high although it should be noted that in the case of the samples collected by Dr. Smith the ice in the container had melted and the samples were two days in transit before reaching the laboratory. The presence of organisms of the B. coli type constantly in 10 c. c., occasionally in 1 c. c. and once in 1/10 c. c., indicates a certain amount of active contamination from animal or human sources and it would seem evident that this contamination is due to the specific insanitary conditions described above.

In view of the foregoing facts the following conclusions may be drawn:

1. That the recommendations of this Department have not been carried out by the local authorities.

2. That the present reservoir is insufficient in size to afford adequate storage or sufficient sedimentation for the removal of turbidity at times of heavy runoff.

3. That the sanitary quality of the supply is menaced by insanitary conditions existing at the three places pointed out in this report and is further menaced by accidental or wilful contamination brought about by the comparatively large force of men engaged in lumbering operations during the winter.

I would therefore recommend:

1. That the village authorities give at once their careful consideration to the recommendations of the previous report.

2. That the village enlarge or rebuild their present reservoir, increasing its capacity sufficiently to afford proper sedimentation and reserve storage.

3. That the board of water commissioners take steps to improve conditions at the various points on the watershed at which contamination may occur from permanent sources and control lumbering operations in such a way as to prevent contamination incidental to this work.

Respectfully submitted,

THEODORE HORTON,
Chief Engineer

ALBANY, N. Y., *April* 20, 1915

REPORT OF WATER ANALYSIS FOR JAY

Source	Tap, public supply	Dam at intake	Dam at intake	Stream at Crown-shield house	Stream at source	Tap in village
Collected on	5/14/12	5/24/12	10/20/14	10/20/14	10/20/14	10/20/14
Color	25	....	5	....	....	....
Turbidity	Cl.	....	....	....	....	....
Odor, cold	1v	....	2a	....	....	....
Odor, hot	1v	....	2a	....	....	....
Solids, total	47	....	94	....	....	....
Loss on ignition	21	....	20	....	....	....
Mineral residue	26	....	74	....	....	....
Ammonia, free	.004	....	.022	....	....	....
Ammonia, albuminoid	.082	....	.064	....	....	....
Nitrites	Trace	....	.001	....	....	....
Nitrates	0.24	....	0.02	....	....	....
Oxygen consumed	6.60	....	3.40	....	....	....
Chlorine	0.25	....	1.18	....	....	....
Hardness, total	23.4	....	55.7	....	....	....
Alkalinity	17.0	....	54.0	....	....	....
Bacteria per c.c.	825	950	*	†2,500	†10,000	†1,700
B. coli type... 10 c.c.	1+2—	2+1—	....	3+0—	2+1—	3+0—
B. coli type... 1 c.c.	0+3—	1+2—	....	0+3—	0+3—	3+0—
B. coli type... 1/10 c.c.	0+3—	....	....	0+3—	0+3—	1+2—

* Bottle cracked in transit.
† Sample two days in transit, and ice in case melted.
Results are expressed in parts per million. + Present. — Absent.
Abbreviations used to describe odors of water: 0, none; 1, very faint; 2, faint; 3, distinct; 4, decided; 5, strong; 6, very strong; a, aromatic; d, disagreeable; e, earthy; f, fishy; g, grassy; m, musty; v, vegetable.

JEFFERSON

HERMANN M. BIGGS, M.D., *State Commissioner of Health:*

An investigation of the public water supply of the village of Jefferson was made on August 3, 1915, by Mr. Morton F. Sanborn, assistant engineer. The inspector was assisted at the time of the inspection by Mr. C. E. Nichols, president of the water company, and Dr. C. H. Topping, health officer of the town of Jefferson.

Jefferson is an unincorporated village in the town of Jefferson and is in the southwestern part of Schoharie county. It is about five miles north of Stamford, which is the nearest railroad station on the Ulster and Delaware railway. The population as estimated at the time of inspection was 250.

The public water supply is owned by the Jefferson Water Works Company and the water works were designed by E. W. Moxley, civil engineer. The water works were constructed by Mr. R. H. Strong and Mr. C. E. Nichols in 1893 under the direction of Mr. Moxley.

The water is obtained from four springs, located at the base of a hill, about one mile southeast of the village. The water is fed directly to the distribution system, which is connected to an artificial reservoir about one-quarter mile from the springs. Fire protection is provided by hydrants which are placed in various parts of the village. Practically all of the population are served by the water supply. No figures on the daily consumption could be obtained since there are no meters on the supply and no method of readily obtaining the amount used. It was estimated, however, that the daily consumption amounted to a total of about 15,000 gallons or about 60 gallons per capita. At certain seasons the people are cautioned not to waste the water in order that the water from the springs will be sufficient without drawing from the reservoir.

There are about two miles of water mains ranging from 4 to 6 inches in diameter. There are about 62 houses in the village of which 59 are served with the water. The water is distributed by gravity and the average pressure in the village is about 120 pounds per square inch.

There are no sewers in the village, cesspools being in common use.

The four springs are located in a slight depression which forms a natural sump for the drainage from the area above. A concrete wall about 3 feet square and about 3 feet deep is constructed around each spring and each spring is covered with a wooden roof. The water from the springs is discharged directly into the distributing mains. At the reservoir about one-quarter of a mile from the springs and about 80 feet lower in elevation an overflow is provided so that the surplus water fed to the mains is discharged into the reservoir and thence flows into the brook, which forms the outlet of the reservoir. The water in the reservoir is not ordinarily used, and it is only at such times as the normal flow from the springs is insufficient to supply the required consumption that water is drawn from the reservoir.

The reservoir is an open earth reservoir and was formed by the construction of an earth dam across the brook which drains the area above and below the springs. The reservoir is about ¾ of an acre in surface area and the greatest depth is from 20 to 25 feet. Riprap was placed on the upstream face of the dam to prevent erosion. It is estimated that the capacity of the reservoir is about 4,000,000 gallons. This would correspond to a consumption of several months. The water in the reservoir appeared quite turbid and this turbidity was probably caused by the heavy rains which were falling during the time of the inspection. Frogs and water insects were observed in the reservoir. The reservoir has never been cleaned and the water mains are flushed out two or three times a year.

The area of the watershed above the springs is about .05 of a square mile and the area at the elevation of the springs from which the water might be drawn is from .3 to .4 of a square mile. The area of the watershed above the reservoir is about ⅓ of a square mile. There is a farmhouse and barn immediately above the springs. This property has not been used for several years and there is probably little or no pollution from this source. The land above the springs was originally used for pasture but in recent years no pasturing has been done there and the land is used chiefly for the production of hay. The ground near the wells was quite wet at the time of the inspection and apparently the springs were receiving some surface water. The soil is generally of sand and gravel formation, although somewhat impervious to the passage of water. The rock formation under the soil consisted largely of sandstone and shale.

At the time of the inspection of this supply a sample of the village water was obtained from a tap in the village and the analysis will be found in the following table:

REPORT OF WATER ANALYSIS FOR JEFFERSON

Laboratory number	B-1027; c-1028
Source	Tap on public supply
Collected on	August 3, 1915
Color	Trace
Turbidity	Clear
Odor, cold	1 v.
Odor, hot	1 v.
Solids, total	25
Loss on ignition	13
Mineral residue	12
Ammonia, free	.028
Ammonia, albuminoid	.018
Nitrites	.001
Nitrates	.360
Oxygen consumed	0.70
Chlorine	1.25
Hardness, total	9.50
Alkalinity	4.00
Bacteria per c.c.	230
B. coli type	10 c.c. Inoculations 3 +0— 1 c.c. Inoculations 1 +0— 1/10 c.c. Inoculations 0 +3—

Results are expressed in parts per million. + Present. — Absent.

Abbreviations used to describe odors of water: 0, none; 1, very faint; 2, faint; 3, distinct; 4, decided; 5, strong; 6, very strong; a, aromatic; d, disagreeable; e, earthy; f, fishy; g, grassy; m ,musty; v, vegetable.

From the results of this analysis it will be seen that the water contains but a trace of color and is practically clear. There is comparatively little organic matter present as shown by the results for nitrogen in its various forms and oxygen consumed. The water is very soft as shown by the figures for hardness and alkalinity. The bacterial count is rather high for a ground water supply and organisms of the B. coli type are found in samples as small as 1 c. c. These results indicate a slight amount of pollution, shown chiefly by the bacterial count and the presence of B. coli. This contamination is probably due to the surface water which reaches the springs.

As a result of this investigation and analysis the following conclusions may be drawn:

1. That the water was of a fairly satisfactory quality although it contained a certain amount of contamination which was probably due to unpurified surface water reaching the spring at times of rainfall.
2. That the water in the reservoir is of a poor esthetic quality due to the frog and insect life and to the fact that the reservoir needs cleaning.

In view of the above conclusions I would recommend that the water company be advised to take steps to carry out the following recommendations in order that the supply may at all times be maintained in a sanitary condition:

1. Protect the springs as much as possible from surface water.
2. Clean the reservoir every two or three years in order that the water in the same may be kept in as clean a condition as possible and algae growths prevented.

Respectfully submitted,

THEODORE HORTON,
Chief Engineer

ALBANY, N. Y., *September* 13, 1915

JEFFERSONVILLE

HERMANN M. BIGGS, M.D., *State Commissioner of Health:*

An inspection of the public water supply of Jeffersonville, was made on July 27, 1915, by Mr. E. S. Chase, assistant engineer, accompanied and aided by Dr. A. H. Schonger, health officer.

Jeffersonville is an unincorporated village located in the northwestern section of Sullivan county on Callicoon creek, ten miles from the nearest railroad station, Callicoon. The village has been formed into a water district under the provisions of the town law and the water supply is under the direction of the board of water commissioners of which Mr. John Glassel is president.

The water supply is derived from a storage reservoir which impounds the waters of Liekel brook about 1¾ miles north of the village. The water works were designed by Mr. J. B. Ryder and constructed under contract in 1902. No data are available as to the daily water consumption although there are approximately 500 people supplied. It is said that there is considerable leakage and waste from the distribution system. The water is distributed by gravity from the reservoir through about 3 miles of water mains ranging in size from 4 to 8 inches in diameter. There are ninety service taps in the village of which none are metered. The average pressure is approximately 65 pounds per square inch. At times of fire the supply from Liekel brook is supplemented by pumping directly into the water mains from Callicoon creek.

The reservoir on Liekel brook is approximately one acre in area with a maximum depth of 20 feet and a capacity of approximately 5,000,000 gallons. This reservoir is formed by an earthen and rubble dam with masonry core walls, clay puddled and riprapped on its inner slope. There are three intakes located on the inner slope of the dam 8, 12 and 16 feet respectively above the bottom of the reservoir. These intakes consist of 4-inch pipes leading into the 8-inch main to the village. The end of these pipes in the reservoir

terminate in concrete boxes, 2 x 2 feet in plan covered with ¼-inch mesh wire screen. The reservoir is also provided with an 8-inch mud pipe for flushing the reservoir at times of cleaning. In addition to the storage reservoir there is a small fire reservoir located west of the village with a capacity of approximately 300,000 gallons. A fire pump for the emergency supply from Callicoon creek is located in a grist mill in the eastern part of the village. This pump is a 6½ x 10 inch Rumsey triplex pump, operated either by gasoline engine or water power; the intake for this supply being from the wheel pit of the grist mill.

The watershed tributary to the Liekel brook reservoir is approximately four square miles in area with an estimated population of 60, or 15 per square mile. This drainage area is a long, narrow valley with steep side hills upon which is comparatively little marsh or swamp land. Sixty to seventy per cent. of the area is cleared land devoted to agriculture and grazing, and the remainder is covered with scattered clump of hardwood timber. The soil is gravel and disintegrated shale over rock strata of shale and sandstone. The slopes are steep and the runoff rapid.

There are approximately twelve dwellings and accompanying outbuildings located on the watershed. Nearly all of these buildings are located back from the stream and its tributaries. The chief opportunity for pollution of this supply is from surface wash, from highways and pasture lands. One house about three miles above the reservoir has a privy located about 100 feet from the stream.

Callicoon creek flows through a rather extensive and fairly thickly populated area. It receives the drainage and surface wash from the vicinity of many dwellings, highways and pasture lands. While its condition is not extremely insanitary, the opportunities for contamination are so numerous that its use must be considered as affording a certain amount of danger to the sanitary quality of the water supply of Jeffersonville.

At the time of the inspection samples of water were collected from Liekel brook supply and also from Callicoon creek. The results of the analyses of these samples made by the Division of Laboratories and Research will be found in the appended table.

These analyses are too few in number to permit the drawing of any sweeping conclusions. The samples were taken after heavy rains and the unsatisfactory bacteriological results are probably due largely to the effect of surface runoff. The total bacterial counts in both the Liekel brook and Callicoon creek supplies are excessive and fecal organisms of the B. coli type are prevalent. From a consideration of the conditions on the Liekel brook watershed it is very probable that these organisms are of animal origin rather than from human sources.

In view of the above facts the following conclusions may be drawn:

1. That the water supply of Jeffersonville derived from Liekel brook is open to indirect contamination by surface wash from pasture lands, manured fields and highways.
2. That the esthetic quality of this supply is affected at times by turbidity caused by surface wash from the highways traversing the watershed area and especially from the highway near and above the reservoir.
3. That the auxiliary supply from Callicoon creek is open to somewhat more serious contamination due to the fact that its course is through a region comparatively thickly settled, where opportunities for accidental and incidental contamination are more numerous.

I would, therefore recommend:

1. That the board of water commissioners of Jeffersonville make regular and thorough inspections of the watershed of Liekel brook in order to detect and remove any permanent sources of contamination.
2. That, in case the water commissioners experience any difficulty in carrying out the above recommendations, they apply to this Department for the enactment of rules and regulations for the sanitary protection of the supply.

3. That the Lickel brook reservoir be protected as much as possible from highway wash by the construction of adequate drainage ditches to divert the road drainage from the nearby highway to a point below the reservoir.

4. That, whenever it is necessary to use the supply from Callicoon creek, ample warning be given to the residents of the village to sterilize by boiling the water used for drinking purposes.

Respectfully submitted,

THEODORE HORTON,
Chief Engineer

ALBANY, N. Y., *September 13, 1915*

REPORT OF WATER ANALYSIS FOR JEFFERSONVILLE

Source		Tap Lickel brook	Callicoon creek
Collected on		7 28 15	7 28 15
Color			10
Odor, hot			2v
Odor, cold			2v
Turbidity			1
Solids, total			46
Loss on ignition			6
Mineral residue			40
Ammonia, free			.010
Ammonia, albuminoid			.080
Nitrites			.004
Nitrates			.000
Oxygen consumed			4.20
Chlorine			1.00
Hardness, total			22.1
Alkalinity			13.0
Bacteria per c.c		55,000	1,500
B. coli type	10 c.c.	3+0—	3+0—
	1 c.c.	3+0—	3+0—
	1 10 c.c.	1+2—	1+2—

Results are expressed in parts per million. + Present. — Absent.

Abbreviations used to describe odors of water: 0, none; 1, very faint; 2, faint; 3, distinct; 4, decided; 5, strong; 6, very strong; a, aromatic; d, disagreeable; e, earthy; f, fishy; g, grassy; m, musty; v, vegetable.

KEESEVILLE

HERMANN M. BIGGS, M.D., *State Commissioner of Health:*

An inspection of the public water supply of Keeseville was made on September 28, 1915, by Mr. E. S. Chase, assistant engineer of this Department. Mr. Chase was accompanied and aided on this inspection by Dr. John A. Smith, sanitary supervisor of District "A."

Keeseville is an incorporated village with an estimated population of 1,800. It is located in the northwestern part of Essex county, about five miles inland from Lake Champlain, on the Keeseville and Ausable Chasm railroad, which connects with the main line of the Delaware and Hudson railroad at Port Kent, about 155 miles north of Albany. The Ausable river flows through the village. There is no public sewer system but various private sewers empty into the river, and there are also numerous cesspools and privies.

The public water supply of Keeseville is derived in part from the Ausable river and in part from a deep well driven near the bank of the river. The intake from the river is located just above the power dam in the village on the south bank of the river. The well is located in the pump station and a few feet from the river's edge. The original water works system was designed by W. H. Lang and constructed by contract under his direction in 1883. The original supply was derived solely from the river. In 1909 two deep wells were driven at the pumping station by Stone & Company of

Utica, N. Y. One of these wells, however, failed to supply a large quantity of water and has been abandoned.

It is estimated that approximately 1,000 people use the supply, or about 55 per cent. of the total population. The daily water consumption is estimated at 250,000 gallons. The water is pumped directly into the distribution system, any excess over consumption being stored in a reservoir located on a hill south of the village. At the time of the inspection the water consumption equaled the amount pumped and no water was stored in the reservoir. There are approximately six miles of water mains ranging in size from 2 to 10 inches in diameter. There are 180 service taps of which 84 are metered. The pressure at the pumping station is about 75 pounds per square inch although at times some difficulty is experienced in obtaining sufficient pressure in the higher portions of the village. The water works are owned and operated by the village under the direction of the board of water commissioners, of which Mr. John Pyper is president.

The river water is carried to the pump by a flume which conveys the water for the water wheels which operate the pumps. This intake takes the water from the river near its surface only a few feet from the south shore of the river. Between the flume and the suction well of the pump there is a galvanized iron screen with ¼-inch mesh.

The driven well which is in use is 503½ feet in depth. Except for a few feet of top soil this well goes through rock strata of varying character. An 8-inch iron casing extends to a depth of 200 feet. It is said that during the preliminary pumping test it was found that the largest amount of water was obtained between the depths of 200 and 300 feet, and it is also claimed that when this well is in operation it draws water from the other well which is not in use.

The pumping station is a rectangular building approximately 20 x 50 feet, built partly of masonry and partly of wood. In this building there are housed the pumps, water wheels and auxiliary steam plant. The river water is pumped by a tandem plunger, double acting Lang pump, 10 x 24-inch stroke, geared to a shaft usually operated by two water wheels. The well pump is a deep well type manufactured by the Keystone Driller Company and has a 5¾ x 18-inch stroke. The auxiliary power equipment consists of a 50 h. p. Erie boiler and a 35 h. p. Erie engine.

The reservoir is of concrete, rectangular in plan, 40 x 80 x 15 feet deep. The side walls extend above the ground and the whole is uncovered. Its capacity is 475,000 gallons.

The water works are in charge of Mr. J. D. Cord, superintendent, and no other men are regularly employed. The well pump is operated for twenty-four hours per day and the river pump from about 7 A. M. to 9 P. M. The water mains are flushed on the average about every two months during warm weather.

The watershed of the Ausable river above Keeseville is approximately 476 square miles. There are several villages and hamlets located in the river valley, but aside from these small centers of population the watershed area is very sparsely inhabited, consisting in the main of steep side slopes of the Adirondack mountains. The total population upon the watershed may be estimated approximately at 9,000 or 19 per square mile. The principal centers of population are Clintonville, Ausable Forks, Black Brook, Jay, Upper Jay, Keene, Keene Valley, Wilmington and Lake Placid. At some of the villages sewers are known to empty directly into the river and its tributaries and it is probable that this is true of the majority of the hamlets. The village of Lake Placid has a sewer system and sewage disposal plant the effluent from which eventually reaches the river. At Ausable Forks the sulphite wastes from a pulp mill also enter the stream. A few hundred feet above the intake there are several tenement houses on the south bank of the river, and at one of these the privy overhangs the stream. On the north bank there are one or two sewers which discharge into the river above the intake. In addition to the numerous permanent sources of contamination of the river there are many other opportunities for the accidental or wilful contamination of the stream by the permanent inhabitants upon the watershed or transient visitors thereto. The unsatisfactory condition of the water derived from the river is well known locally

and very few if any of the inhabitants use the public supply for drinking purposes without boiling.

The location of the auxiliary well in the vicinity of a thickly settled neighborhood renders it open to considerable suspicion. In addition to the general possibility of serious contamination of the ground water tributary to the well, there is a poorly constructed stone sewer, carrying the storm water and sewage from three or four houses, which passes within a few feet of the well. It seems, therefore, extremely probable that at times the well water receives contamination either from this sewer or from the various privies and leaching cesspools in the village. While the well is driven through rock and is cased to a depth of about 200 feet, there exists a possibility of seams or channels which may carry active contamination from the surface to the well.

At the time of the inspection samples of water were collected from both the well and the Ausable river and the results of the analyses of these samples, together with others made in the past by the Division of Laboratories and Research, will be found in the accompanying table.

These analyses show a water somewhat variable in quality, due possibly in part to variations in the relative amounts of water from the two sources. The water is usually moderately colored and occasionally turbid. The water from the well is very much harder than that from the river. The total bacterial counts are usually rather high and fecal organisms of the B. coli type occasionally present in samples as small as 1/10 c.c. The comparatively high figures for chlorine in the single separate analysis of the well supply indicate the possibility of contamination of the ground water supply, as does the presence of B. coli in 10 c.c. inoculations. The analytical results indicate the unsatisfactory sanitary quality of the water supplies derived from both the Ausable river and the deep well.

In view of the above facts the following conclusions may be drawn:

1. That the public water supply of Keeseville derived from the Ausable river is unsatisfactory from both the physical and sanitary standpoint.
2. That the supply from the Ausable river is highly colored, at times turbid and frequently contains sulphite wastes and other manufacturing wastes which render the supply extremely unpalatable.
3. That the numerous sources of direct and indirect contamination existing upon the watershed of the Ausable river renders this supply decidedly unsafe for potable purposes.
4. That the well supply of Keeseville is open to contamination owing to its location in a thickly settled neighborhood and to the numerous possibilities of direct contamination by leaky sewers, leaching cesspools, etc.
5. That the supply obtainable from this well is insufficient in quantity in addition to its potentially dangerous sanitary quality.

I would, therefore, recommend:

1. That the village authorities take immediate steps to obtain a new and satisfactory water supply, considering the following methods of development:
   (a) Filtration and sterilization of the Ausable river.
   (b) New wells located in such a position as to be free from all possible sources of contamination.
   (c) A surface supply from some watercourse or pond in the hills located near the village, such a source should be free from contamination or else subjected to some form of purification.
2. That the village authorities retain the services of a competent sanitary engineer to advise them as to the best and most economical methods for the development of such a new supply.
3. That pending the installation of a new supply of satisfactory quality the village provide a sterilization apparatus for the treatment of their present supply with liquid chlorine.

Respectfully submitted,

THEODORE HORTON,

Chief Engineer

ALBANY, N. Y., *October* 30, 1915

RESULTS OF WATER ANALYSES

Municipality	County	Source of sample	Date of collection	Physical				Chemical (Parts per Million)											Bacteriological			
						Odor		Solids			Nitrogen as—						Hardness			B. Coli Type + = present — = absent		
				Color	Turbidity	Cold	Hot	Total	Loss on ignition	Mineral residue	Free ammonia	Albuminoid ammonia	Nitrites	Nitrates	Oxygen consumed	Chlorine	Total	Alkalinity	Bacteria per c.c.; gelatin 20°; 48 hours	10 c.c.	1 c.c.	1-10 c.c.
Keeseville	Essex	Tap, public supply	3/ 9/11	20	5	....	....	123	62	61	.050	.130	.002	0.20	18.6	0.50	54.3	33.0	700	+	+	+
Keeseville	Essex	Tap, public supply	10/ 4/11	25	15	....	....	120	52	68	.010	.144	.002	0.10	15.9	1.50	39.0	26.0	550	+	+	+
Keeseville	Essex	Tap, public supply	11/13/11	40	2	....	....	122	83	39	.034	.142	.002	0.40	53.2	1.00	35.1	15.0	2,400	+	+	+
Keeseville	Essex	Tap, public supply	1/ 5/12	5	Cl.	....	....	159	12	147	.058	.032	.007	0.06	2.60	1.37	145.8	141.0	140	+	—	—
Keeseville	Essex	Tap, public supply	2/ 7/12	5	Tr.	....	....	157	12	145	.050	.038	Tr.	0.04	4.10	0.87	145.8	145.0	20	—	—	—
Keeseville	Essex	Tap, public supply	3/13/12	3	Cl.	....	....	174	17	157	.064	.028	Tr.	0.04	3.30	1.50	145.8	144.0	190	—	—	—
Keeseville	Essex	Tap, public supply	4/17/12	15	5	....	....	176	20	156	.048	.030	.001	0.02	2.90	1.75	117.2	......	500	+	—	—
Keeseville	Essex	Tap, public supply	9/ 5/12	27	2	....	....	162	24	138	.048	.016	.002	0.08	4.90	1.75	111.4	......	40	+	—	—
Keeseville	Essex	Tap, public supply	10/24/12	15	Tr.	....	....	162	28	134	.052	.056	.003	0.06	4.50	2.00	131.4	......	1,200	+	—	—
Keeseville	Essex	Tap, public supply	12/ 5/12	15	Tr.	....	....	172	23	149	.058	.022	.003	0.08	3.80	2.50	140.0	130.0	500	+	—	—
Keeseville	Essex	Tap, public supply	1/ 8/13	10	Cl.	....	....	206	....	....	.052	.020	.004	0.08	2.60	2.25	137.2	136.0	750	+	+	+
Keeseville	Essex	Tap, public supply	2/12/13	5	5	....	....	163	....	....	.032	.012	.001	0.10	3.40	3.50	140.0	138.0	240	—	—	—
Keeseville	Essex	Tap, public supply	3/26/13	15	Cl.	....	....	163	....	....	.030	.030	.001	0.10	2.50	2.50	114.2	130.0	110	—	—	—
Keeseville	Essex	Tap, public supply	5/ 7/13	3	Tr.	....	....	164	....	....	.008	.008	.001	0.10	2.30	2.50	122.8	122.0	100	+	+	—
Keeseville	Essex	Tap, public supply	6/18/13	15	3	....	....	188	....	....	.014	.014	.002	0.08	5.70	2.25	102.8	......	15	+	—	—
Keeseville	Essex	Tap, public supply	7/23/13	17	Tr.	....	....	169	....	....	.018	.018	.002	0.10	4.50	3.50	142.8	128.0	1,600	+	+	—
Keeseville	Essex	Tap, public supply	5/12/14	10	2	1 v.	1 v.	151	13	138	.014	.012	.002	0.06	2.10	2.50	128.6	126.0	40	+	—	—
Keeseville	Essex	Tap, public supply	9/28/15	....	....	....	....	....	....	....	....	....	....	0.24	2.00	......	......	......	850	3+0—	3+0—	3+0
Keeseville	Essex	Tap, well pump	9/28/15	5	Tr.	1 v.	1 v.	161	21	140	.036	.036	Tr.	0.10	12.4	2.50	128.6	127.0	20	3+0—	0+3—	0+3—
Keeseville	Essex	Ausable river	9/28/15	....	....	....	....	....	....	....	....	....	....	0.32	....	2.00	......	......	3,200	3+0—	3+0—	3+0—
Keeseville	Essex	Ausable river	10/ 1/15	20	Tr.	2 v.	2 v.	124	48	76	.004	.078	.005	0.30	28.0	0.25	41.6	23.0	......	......	......	......

KINGS PARK STATE HOSPITAL

Plans and specifications covering two additional wells to increase the water supply of the Kings Park State Hospital, submitted by Hon. Lewis F. Pilcher, State Architect, on August 13, 1915, were approved by this Department on August 31, 1915.

KINGSTON

HERMANN M. BIGGS, M.D., *State Commissioner of Health:*

A reinspection of the public water supply of the city of Kingston was made on January 11, 18, 19 and 20, 1915, by Dr. C. W. Berry, sanitary supervisor of District "N," and the following facts are based largely upon information furnished by him. An earlier report of a full investigation of this water supply by the Engineering Division will be found on page 560 of the thirty-first annual report of this Department.

The water supply of this city is derived from the Saw Kill creek rising in the Catskill mountains several miles west of the city. This supply is supplemented in summer by water from the Mink Hollow creek which is diverted into one of the reservoirs. The water is collected in four impounding reservoirs, passed through mechanical pressure filters, using sulphate of aluminum as a coagulant and the filtered water sterilized with hypochlorite of lime. The water works system remains practically the same as at the time of the earlier report. One of the impounding reservoirs, Coopers Lake, has had its capacity increased, by the construction of a higher dam, from 200,000,000 gallons to 400,000,000 gallons thus bringing the total storage capacity up to 567,000,000 gallons. An additional 20-inch pipe line is now under construction from the lower reservoir to the city. Four additional filters are to be added in the near future in order to care for the increasing amount of water consumption. The daily consumption at the time of the inspection was about 4,500,000 gallons. The higher consumption given in the previous report was based on Venturi meter records which were too high on account of an obstruction in the meter tube.

A full description of the filters, reservoir and pipe lines is given in the report of the previous investigation. Since the previous report the system of application of the coagulant has been changed and the use of hypochlorite of lime begun. The apparatus for the application of the alum consists of four wooden tanks, 6 feet 6 inches in diameter and 6 feet deep; each containing a dissolving rack and spray pipe and agitators run by water motor. The hypochlorite of lime is mixed first as a paste in two cast iron mixing tanks, each containing a stirrer operated by a water motor, and then this paste is run into four concrete solution tanks each 3½ feet square in plan and 4 feet deep; also containing stirrers for thorough mixing. From the respective solution tanks both the alum and hypochlorite solutions are pumped into the water mains by hydraulic pumps. As there are two sets of filters, one set for the low service, the other set for the high service, the chemicals are added by two pumps. These pumps are provided with two cylinders, one for the alum solution and the other for the hypochlorite solution. These pumps have given some trouble and have been overhauled and put into adjustment recently. The alum is applied to the raw water before it enters the filters and the hypochlorite is applied to the filtered water. The hypochlorite solution can also be pumped into the raw water previous to filtering or in case the filters should be by-passed. The amount of alum used averages about 0.25 grain per gallon or 36 pounds per million gallons. During December, 1914, the bleach was added at an average rate of 6.5 pounds per million gallons or approximately 0.26 part per million by weight of available chlorine.

The watershed from which the supply is obtained is about 33 square miles in area, comprising a portion of the southern slope of the Catskill mountains. The northern portion of the watershed is steep and rocky and is for the most part covered with second growth timber, the southern portion is not so steep and is used largely for agricultural purposes. During the winter the supply obtained from Mink Hollow creek is not used.

The resident population on the watershed is about 1,000, practically all of which is located on the southern part with an average density of 26 per square mile. The region is largely used as a summer resort, and the population trebles in the warm months. The construction of the Ashokan reservoir of the New York City supply has necessitated the relocation of the Ulster & Delaware railroad in such a way as to render the region of the Kingston watershed somewhat more accessible. In 1911 this Department enacted revised rules and regulations for the sanitary protection of this watershed and during the summer months a man is kept constantly patrolling the region to enforce these rules. The Mink Hollow watershed has an area of about 8 square miles and a population of probably 80, or 10 per square mile.

At times trouble has been experienced with algae growths in the reservoir, especially in the spring and summer. Such trouble has been controlled by use of copper sulphate applied at the rate of 2½ to 3 pounds per million gallons.

The previous report on this water supply pointed out the danger of serious contamination of the water supply from human sources due to the comparatively large population upon the watershed. Furthermore at that time the filter plant was not operating efficiently and the method of applying the alum by means of the "shunt" system was unsatisfactory and incapable of accurate control.

It was, therefore, recommended:

1. A thorough inspection should be made of the entire watershed of Sawkill creek and also of Mink Hollow brook, provided it is intended to continue to use that stream as a source of supplementary supply, and steps taken to enforce the rules and regulations enacted by this Department for the protection of their water supply, to remove as far as possible all existing violations of these rules and sources of contamination of their supply and to guard against their recurrence in the future.
2. The watershed of Sawkill creek is becoming increasingly popular as a summer resort, and an increasingly serious element of danger lies in the pollution from the large number of tourists and summer boarders living in isolated houses and camps. The only effective protection of the water supply that can be secured against such pollution is the efficient filtration of the water before it supplies the city.
3. Immediate steps should, therefore, be taken to increase the efficiency of the filter plant by scientifically applying the coagulant to the raw water and by placing the operation of the plant under the supervision of some sanitary expert.

Subsequent to this investigation Mr. Allen Hazen, consulting engineer, investigated and reported upon the water supply system. The report of Mr. Hazen confirmed the findings of this Department and gave detailed advice relative to the improvements of the methods of operation and supervision of the filters.

According to the data furnished by Dr. Berry the following improvements have been made since the earlier report:

(a) The storage capacity of Cooper lake has been doubled by the construction of a new dam.

(b) A new 20-inch main is under construction from the filter house to the city.

(c) The regulations of this Department for the sanitary protection of the water supply are more strictly enforced and a patrolman employed during the summer months.

(d) Sulphate of aluminum is now used as a coagulant instead of crude alum and the method by which it is applied is much more accurate than formerly.

(e) The filtered water is also treated with hypochlorite of lime.

(f) Chemical and bacteriological examinations of the treated and raw water are made daily and regular records kept of the results. These results are used to adjust the treatment to the needs of the water.

At the time of his inspection Dr. Berry collected samples of filtered and unfiltered water for analysis and the results of these analyses, together with others made in the past by the Division of Laboratories and Research will be found in the appended table.

These analyses show that as a rule excellent bacteriological results have been obtained. The more recent analyses showing the absence of B. coli in samples as large as 30 c. c. and present in 1 c. c. only once in the past 3 years. The samples collected by Dr. Berry show a reduction of 99.3 per cent. in total numbers of bacteria and the elimination of B. coli by the purification process.

In view of the above facts the following conclusions may be drawn:

1. That the city authorities of Kingston have carried out the recommendations of this Department.

2. That under the present conditions upon the watershed and in view of the control of the possible contamination by the enforcement of the rules and regulations and the apparently careful and efficient operation of the purification plant, the water supply of the city should be of a safe and satisfactory sanitary quality.

It, therefore, seems evident that for the present no further recommendation need be made other than that the city authorities be urged to continue their careful supervision of their water supply.

Respectfully submitted,

THEODORE HORTON,
Chief Engineer

ALBANY, N. Y., *March* 15, 1915

RESULTS OF WATER ANALYSES

Abbreviations used to describe odors of water: 0, none; 1, very faint; 2, faint; 3, distinct; 4, decided; 5, strong; 6, very strong; a, aromatic; d, disagreeable; e, earthy; f, fishy; g, grassy; m, musty; v, vegetable

Municipality	County	Source of sample	Date of collection	Physical				Chemical (Parts Per Million)											Bacteriological			
						Odor		Solids			Nitrogen as—						Hardness		Bacteria per c.c.; gelatin 20°; 48 hours	B. Coli Type + = present — = absent		
				Color	Turbidity	Cold	Hot	Total	Loss on ignition	Mineral residue	Free ammonia	Albuminoid ammonia	Nitrites	Nitrates	Oxygen consumed	Chlorine	Total	Alkalinity		10 c.c.	1 c.c.	1-10 c.c.
Kingston	Ulster	Tap, high service	1/24/12	Tr.	Cl.	....	....	40	8	32	.074	.040	.002	0.26	0.40	1.25	24.7	8.0	60	+	—	—
Kingston	Ulster	Tap, low service	1/24/12	Tr.	Cl.	....	....	34	9	25	.132	.042	.001	0.36	0.88	1.50	22.1	5.0	160	+	—	—
Kingston	Ulster	Tap, high service	2/27/12	1	Cl.	....	....	43	8	35	.312	.056	Tr.	0.24	1.00	1.50	15.6	3.0	800	—	—	—
Kingston	Ulster	Tap, low service	2/27/12	Tr.	Cl.	....	....	41	13	28	.326	.056	Tr.	0.24	0.80	1.25	14.3	3.0	1,000	+	—	—
Kingston	Ulster	Tap, high service	4/ 5/12	5	Cl.	....	....	21	8	13	.174	.042	Tr.	0.04	1.70	0.75	11.1	4.0	30	+	—	—
Kingston	Ulster	Tap, low service	4/ 5/12	Tr.	Cl.	....	....	34	8	26	.182	.038	Tr.	0.04	1.00	0.75	12.7	2.0	20	—	—	—
Kingston	Ulster	Tap, high service	5/ 3/12	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	170	+	—	—
Kingston	Ulster	Tap, low service	5/ 3/12	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	48	+	—	—
Kingston	Ulster	Tap, high service	10/ 4/12	Tr.	Cl.	....	....	39	12	27	.146	.024	.001	0.12	1.00	1.75	19.5	15.0	30	—	—	—
Kingston	Ulster	Tap, low service	10/ 4/12	5	Tr.	....	....	44	17	27	.124	.038	.001	0.24	1.00	1.25	23.4	14.0	70	+	—	—
Kingston	Ulster	Tap, high service	11/ 9/12	10	Tr.	....	....	31	11	20	.048	.104	Tr.	0.16	3.50	1.75	14.3	6.0	400	—	—	—
Kingston	Ulster	Tap, low service	11/ 9/12	20	Tr.	....	....	36	15	21	.020	.072	.001	0.14	3.80	2.25	15.6	8.0	600	+	+	—
Kingston	Ulster	Tap, high service	1/16/13	Tr.	Cl.	1 v.	1 v.	30	....	....	.138	.026	Tr.	0.22	0.40	1.75	15.6	2.0	10	0+3—	0+3—	0+3—
Kingston	Ulster	Tap, low service	1/16/13	Tr.	Cl.	1 v.	1 v.	33	....	....	.150	.034	.001	0.34	0.20	1.62	14.3	4.0	20	0+3—	0+3—	0+3—
Kingston	Ulster	Tap, high service	3/14/13	Tr.	Cl.	1 v.	1 v.	29	....	....	.242	.026	Tr.	0.16	0.40	1.37	11.1	6.0	20	0+3—	0+3—	0+3—
Kingston	Ulster	Tap, low service	3/14/13	Tr.	Cl.	1 v.	1 v.	32	....	....	.218	.022	Tr.	0.20	0.60	1.37	16.9	4.0	30	0+3—	0+3—	0+3—
Kingston	Ulster	Tap, high service	4/18/13	1	Cl.	1 v.	1 v.	53	....	....	.222	.024	.001	0.34	0.50	1.25	19.5	7.0	15	0+3—	0+3—	0+3—
Kingston	Ulster	Tap, low service	4/18/13	Tr.	Cl.	1 v.	1 v.	28	....	....	.214	.026	.001	0.34	0.30	0.75	18.2	5.0	20	0+3—	0+3—	0+3—
Kingston	Ulster	Tap, high service	6/ 5/13	Tr.	Cl.	1 v.	1 v.	86	....	....	.152	.028	Tr.	0.12	0.50	1.50	15.6	8.0	90	0+3—	0+3—	0+3—
Kingston	Ulster	Tap, low service	6/ 5/13	10	2	1 v.	1 v.	32	....	....	.006	.042	Tr.	0.06	1.70	1.25	12.7	11.0	130	1+2—	0+3—	0+3—
Kingston	Ulster	Tap, high service	7/ 9/13	Tr.	Cl.	1 v.	1 v.	31	....	....	.084	.022	Tr.	0.18	0.20	1.25	20.8	12.0	160	0+3—	0+3—	0—3—
Kingston	Ulster	Tap, low service	7/ 9/13	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	240	0+3—	0+3—	0—3—
Kingston	Ulster	Tap, high service	1/16/14	5	Tr.	1 v.	2 v.	37	10	27	.052	.018	.005	0.36	1.00	2.50	18.2	11.0	20	0+3—	0+3—	0+3—
Kingston	Ulster	Tap, low service	1/16/14	5	Cl.	1 v.	2 v.	28	7	21	.036	.014	.004	0.20	1.40	2.50	19.5	10.0	30	0+3—	0+3—	0+3—
Kingston	Ulster	Tap, high service	3/26/14	8	2	1 v.	1 v.	30	12	18	.138	.084	.001	0.14	1.70	1.00	12.7	6.0	1,700	0+3—	0+3—	0+3—
Kingston	Ulster	Tap, low service	3/26/14	8	1	1 v.	1 v.	21	2	19	.150	.076	.001	0.16	1.50	1.00	9.5	6.0	750	0+3—	0+3—	0+3—
Kingston	Ulster	Cooper Lake	1/11/15	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	1,100	1+2—	2+1—	0+3—
Kingston	Ulster	Reservoir No. 4	1/11/15	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	9,500	3+0—	2+1—	0+3—
Kingston	Ulster	Untreated water reservoir 1 and 2	1/11/15	8	1	1 v.	1 v.	30	6	24	.006	.030	Tr.	0.20	2.10	2.00	22.1	5.0	500	3+0—	1+2—	0+3—
Kingston	Ulster	Tap, treated water	1/11/15	5	Cl.	1 v.	1 v.	26	11	15	.006	.024	Tr.	0.20	0.60	2.00	15.6	5.0	+	3+0—	1+2—	0+3—

LARCHMONT

HERMANN M. BIGGS, M.D., *State Commissioner of Health:*

A reinspection of the public water supply of Larchmont was made on October 20, 1914, by Dr. L. W. Hubbard, sanitary supervisor of District "T," and the following report is based largely upon information furnished by him. A full investigation of this supply was made by the engineering division in October, 1912, and the report of this investigation will be found on page 696 of the thirty-third annual report of this Department. An earlier inspection was made of the watershed tributary to the supply in May, 1911. (See page 657, thirty-second annual report.)

The water supply of this village is derived from the Sheldrake river at a point about 2½ miles northwest of the village. There are three storage reservoirs upon this stream and from the lower one of these reservoirs the water flows by gravity to mechanical pressure filters nearby. After filtration the water is delivered by gravity to the village. The water works system, the methods of operation of the filters, water consumption and population of village remain the same as at the time of the previous inspection in 1912. The water works are owned and operated by the Larchmont Water Company.

The watershed of the Sheldrake river above the water works intake is approximately 2.5 square miles in area and lies almost wholly within the boundaries of the city of New Rochelle. Although this area is not thickly populated the completion of the N. Y., W. & B. R. and the establishment of two railroad stations on the watershed have opened up this territory for development.

At the Quaker Ridge station, located about 1¼ miles above the lower reservoir, the river is carried under the station grounds through two 48-inch pipes for a distance of several hundred feet from the stream and there is little danger of contamination from it save in case of its overflow. The number of passengers entering and leaving the station does not exceed 50 per day and the average is about 25. The cesspool is of concrete and is frequently cleaned, the material being pumped into a tank wagon and drawn away. The point of disposal of this material was not learned.

The washings from the roadways and station grounds reach the stream, but the traffic is light and mostly automobile. Six houses have been erected in the vicinity of the station, the nearest of which is about 800 feet from the river.

At the Heathcote station, three-quarters of a mile further up stream, the toilet is not in use as there is no water supply. No houses have as yet been built in the vicinity of this station. The trains on the railroad are not equipped with toilets as the service is local. The other conditions upon the watershed remain the same as at the time of the inspection in 1912.

In the report of this previous investigation it was pointed out that the Sheldrake river was subject to considerable direct pollution from the population occupying the watershed in proximity to the stream: that real estate developments would increase this resident population and consequently increase the amount of pollution reaching the river; that the filter plant, although effecting a reasonable improvement in the physical quality of the water, was not efficient at all times in the removal of bacteria. In view of these conclusions the following recommendations were made:

1. That the Larchmont Water Company apply to this Department for the enactment of rules and regulations for the sanitary protection of the public water supply of the village, in order that the amount of pollution from the growing population may be prevented as far as practicable.

2. That immediate steps be taken by the Larchmont Water Company to increase the efficiency of the filter plant, and, if necessary, to apply under expert supervision hypochlorite of lime to the effluent of the filters as an additional safeguard against infection of the village water supply.

It appears from information obtained by Dr. Hubbard that neither of these recommendations has been carried out and also that there is no intention on the part of the water company to take any action upon these recommendations. Furthermore, the water company discontinued about two years ago the regular monthly analyses of the treated water, these analyses having been made by the Lederle Laboratories of New York.

At the time of the recent inspection samples of both raw and treated water were collected by Dr. Hubbard and the results of the analyses of these samples together with others made since the previous inspection will be found in the appended table.

These analyses bear out the conclusion of the previous report that the filters do not efficiently remove the bacteria and furthermore indicate that the filters do not at all times bring about complete removal of color and turbidity. Only when operated with constant and exceptional care and intelligence do pressure mechanical filters afford adequate means of purifying a polluted water supply. Frequent and regular analyses of both the raw and treated water give information as to the efficiency of the filters and give warning when improvements or changes are necessary in the methods of operation.

In view of the above facts the following conclusions may be drawn:

1. That the Larchmont Water Company has failed to carry out any of the recommendations of the previous report.
2. That the discontinuance of the regular analyses indicates a comparative indifference as to the quality of water on the part of the water company.
3. That, as noted in the previous report, the Sheldrake river is subject to considerable contamination from the present population on the watershed and that this contamination will increase as the population increases.
4. That the present filter plant, as also noted in the previous report, does not effect a satisfactory removal of bacteria.

I would therefore recommend:

1. That the Larchmont Water Company apply to this Department for the enactment of rules and regulations for the sanitary protection of the water supply.
2. That the water company install at once apparatus for the sterilization of the water with liquid chlorine or hypochlorite of lime.
3. That the water company resume the regular analyses of both raw and treated water.

Respectfully submitted,
THEODORE HORTON,
Chief Engineer

ALBANY, N. Y., *January* 15, 1915

RESULTS OF WATER ANALYSES

Abbreviations used to describe odors of water: 0, none; 1, very faint; 2, faint; 3, distinct; 4, decided; 5, strong; 6, very strong; a, aromatic; d, disagreeable; e, earthy; f, fishy; g, grassy; m, musty; v, vegetable

Municipality	County	Source of sample	Date of collection	Physical				Chemical (Parts per Million)											Bacteriological			
						Odor		Solids			Nitrogen as—						Hardness			B. Coli Type (+ = present, — = absent)		
				Color	Turbidity	Cold	Hot	Total	Loss on ignition	Mineral residue	Free ammonia	Albuminoid ammonia	Nitrites	Nitrates	Oxygen consumed	Chlorine	Total	Alkalinity	Bacteria per c.c.; gelatin 20°, 48 hours	10 c.c.	1 c.c.	1-10 c.c.
Larchmont....	Westchester....	Tap public supply..........	12/19/12	Tr.	Cl.	....	....	92	25	67	.036	.090	Tr.	0.24	2.20	6.25	45.7	21.0	100	0+3—	0+3—	0+3—
Larchmont....	Westchester....	Tap, public supply..........	1/22/13	Tr.	Tr.	1 a.	1 a.	97	....	....	.010	.054	Tr.	0.80	0.80	5.50	36.4	11.0	10	0+3—	0+3—	0+3—
Larchmont....	Westchester....	Tap, public supply..........	2/26/13	5	Tr.	1 v.	1 v.	116	....	....	.022	.066	Tr.	0.70	1.20	6.00	44.3	18.0	100	0+3—	0+3—	0+3—
Larchmont....	Westchester....	Tap, public supply..........	4/ 9/13	Tr.	Tr.	1 v.	1 v.	73	....	....	.012	.048	Tr	0.44	1.10	4.25	32.5	14.0	230	0+3—	0+3—	0+3—
Larchmont....	Westchester....	Tap, public supply..........	5/21/13	Tr.	Cl.	1 v.	1 v.	88	....	....	.012	.066	.001	0.26	1.90	4.25	32.5	18.0	10	1+2—	0+3—	0+3—
Larchmont....	Westchester....	Tap, public supply..........	6/30/13	5	2	2 v.	2 v.	91	....	....	.010	.134	Tr.	0.08	2.30	4.25	36.4	24.0	100	1+2—	0+3—	0+3—
Larchmont....	Westchester....	Tap, public supply..........	1/28/14	15	8	1 v.	1 v.	102	31	71	.002	.084	Tr.	0.44	5.10	5.63	44.3	23.0	*.......	3+0—	1+2—	0+3—
Larchmont....	Westchester....	Tap, public supply..........	3/18/14	18	5	1 v.	1 v.	75	22	53	.036	.086	Tr.	0.36	3.20	1.00	27.3	14.0	*11,000	3+0—	2+1—	0+3—
Larchmont....	Westchester....	Tap, public supply..........	5/21/14	Tr.	Tr.	1 v.	1 v.	121	29	92	.008	.038	Tr.	0.16	1.70	4.00	40.3	20.0	350	0+3—	0+3—	0+3—
Larchmont....	Westchester....	Sheldrake river..............	10/20/14	....	....	....	....	....	....	....	....	....	....	....	....	......	......	......	700	3+0—	1+2—	0+3—
Larchmont....	Westchester....	Reservoir..................	10/20/14	....	....	....	....	....	....	....	....	....	....	....	....	......	......	......	11,700	3+0—	2+1—	0+3—
Larchmont....	Westchester....	Tap, public supply..........	10/20/14	....	....	....	....	....	....	....	....	....	....	....	....	......	......	......	85	1+2—	1+2—	0+3—

* Delayed in transit.

LIBERTY

HERMANN M. BIGGS, M.D., *State Commissioner of Health:*

A reinspection of the public water supply of Liberty was made on July 26, 1915, by Mr. E. S. Chase, assistant engineer in this Department. A previous inspection of this supply was made by Prof. H. N. Ogden in 1912, the report of whose investigation is on file in this Department.

Liberty is an incorporated village with a population of approximately 2,700 located in the north central part of Sullivan county on the N. Y., O. & W. R. R. It is principally a summer resort and also has a large tuberculosis sanatorium. During the summer the population is largely increased. The village is served by a municipally owned sewer system and a modern sewage disposal plant.

The water supply is derived from a small brook or stream known as Darbee brook, which is supplemented during the summer by water pumped from Revonah lake. The water supply system was designed by Wise and Watson, civil engineers, and constructed under contract in the year 1893. In 1895 it was found necessary to supplement the Darbee brook supply by pumping from Revonah lake. In 1914 a new reservoir was constructed for the distribution of the water pumped from the lake.

Approximately 95 per cent. of the entire population is served by the supply and the average consumption is approximately 100,000 gallons. There are no industries in the village but comparatively large amounts of water are used by the hotels, boarding-houses, and the railroad. The supply is distributed by gravity through about 8 miles of water mains ranging in size from 4 to 8 inches in diameter. Of the 550 service taps, 450 are metered. The pressure varies from 50 pounds per square inch in the hill section to 125 pounds per square inch in the lower sections of the village. The water works are owned and operated by the village under the direction of the board of water commissioners, of which Mr. Isham Young is the president and Mr. Robert Harby clerk.

The reservoir on Darbee brook is about one acre in area and is formed by an earthen dam with masonry core walls, riprapped on its inner slope. The capacity of this reservoir is approximately 1,000,000 gallons. Above this reservoir a new concrete reservoir for receiving the Revonah lake water has been constructed. This reservoir is 65 by 100 feet in plan with a maximum depth of 12 feet. Its capacity is estimated at 500,000 gallons. The valves and pipe system are so arranged that water from this reservoir may be discharged into the lower reservoir or by-passed around it into the distribution system of the village. The distribution system is so arranged that a portion of the village may be served by a high pressure service from this reservoir and the other portion by a low pressure service from the lower reservoir. At present, however, the whole village is being served from the lower reservoir.

There are two intake pipes at Revonah lake which extend about 300 feet from shore into 9 feet of water. Half bends in these pipes bring the ends of the intakes about 3 feet below water level. The pumping station consists of a wooden building containing two Worthington duplex pumps having a capacity of 115,000 and 75,000 gallons per day respectively. These pumps are operated by steam from a 50 hosepower boiler.

The watershed of Darbee brook is approximately one-half square mile in area. A large portion of this area is wooded and the remainder is devoted to pasture lands and agriculture. There are three or four houses located on this area, all of which are well distant from the stream. The upper end of the watershed is crossed by a highway. The chief sources of contamination for this supply seem to be from the surface wash from the pasture lands and the highway.

Revonah lake is a small spring fed lake located in a natural depression among the hills. The surface watershed tributary to it is very small and probably does not exceed one-half square mile in area. There are but three houses located on this area and these are summer cottages located near the

southwestern shore of the lake. At two of these cottages the privies are located about 75 feet from the edge of the lake and at the time of the inspection were in a very poor sanitary condition. It would be a very simple matter to locate these privies 100 feet or so to the west, over a ridge and on a slope draining away from the lake. The lake is used for boating, fishing and bathing and to some extent for ice cutting. The lake is not owned by the village but the right to withdraw 300,000 gallons of water daily from it has been purchased by the village.

At the time of the previous inspection it was pointed out that the lower reservoir was receiving a certain amount of pollution from a small stream which received drainage from a farm and pasture near the upper end. Although at that time an attempt had been made to divert this stream from the lower reservoir, it was found that the dam turning it from its course was not entirely watertight and that a large proportion of the flow of the stream was reaching the reservoir. It was therefore recommended that the water board immediately repair the dam and prevent absolutely any of the water from this stream finding its way into the reservoir. The conditions at Revonah lake as discussed above were also in existence at the time of the previous inspection and it was, therefore, recommended that the privies and cottages should be moved outside the watershed or else provided with watertight vaults. Occasional inspection of the watersheds was advised and also that particular effort be given to preventing any possible pollution from the two cottages on Revonah lake.

At the time of the recent inspection samples of the water were collected from Revonah lake and from a tap in the village; the latter sample representing water derived from the Darbee brook. The results of the analyses of these samples together with others made in the past by the Division of Laboratories and Research will be found in the appended table.

These analyses show a very soft water, somewhat colored and at times slightly turbid. The figures for nitrogen in its various forms are moderately high indicating the presence of a certain amount of decomposable and decomposing organic matter. The chlorine content is somewhat variable and in most cases above the normal for this vicinity. The bacterial counts are occasionally low although usually comparatively high even for a surface supply. Organisms of the B. coli type are usually present in 10 c. c. and occasionally present in 1 c. c. indicating the presence of active contamination of animal or human origin. The samples collected at the time of the recent inspection show clearly the effect of surface runoff subsequent to heavy rains in the vicinity. From the inspection it would appear that the somewhat unsatisfactory bacterial results are due to the contamination of the supply by surface wash from pasture lands and is consequently mainly of animal rather than of human origin. The sanitary quality of the supply obtained from Revonah lake is somewhat better than that derived from Darbee brook being lower in total count and with fewer organisms of the B. coli type.

In view of the facts the following conclusions may be drawn:

1. That the public water supply of Liberty as derived from Darbee brook is open to objection from a sanitary standpoint owing to the opportunity for contamination of animal origin.

2. That the supply derived from Revonah lake is of a reasonably satisfactory, esthetic quality, but the sanitary quality is menaced by the location of camps upon its shores and the use of the lake for bathing purposes.

3. That both supplies are open to chance contamination of an accidental or wilful nature by residents upon or visitors to the watershed.

I would therefore recommend:

1. That the village authorities consider the question of installing a modern filtration plant for the purification of the supply derived from Darbee brook, such a plant would not only improve the sanitary quality of the water but would also improve the esthetic quality by removing turbidity and, to some extent, color.

2. That the village apply to this Department for the enactment of rules and regulations for the sanitary protection of the water supply derived from both Darbee brook and Revonah lake.

3. That the village install and operate apparatus for the sterilization of its water supply with liquid chlorine in order to eliminate all danger of chance contamination of the supply.

Respectfully submitted,

THEODORE HORTON,
Chief Engineer

ALBANY, N. Y., *September* 11, 1915

RESULTS OF WATER ANALYSES

Abbreviations used to describe odors of water: 0, none; 1, very faint; 2, faint; 3, distinct; 4, decided; 5, strong; 6, very strong; a, aromatic, d, disagreeable; e, earthy; f, fishy; g, grassy; m, musty; v, vegetable

Municipality	County	Source of sample	Date of collection	PHYSICAL				CHEMICAL (PARTS PER MILLION)											BACTERIOLOGICAL			
						ODOR		SOLIDS			NITROGEN AS—						HARDNESS			B. COLI TYPE + = PRESENT — = ABSENT		
				Color	Turbidity	Cold	Hot	Total	Loss on ignition	Mineral residue	Free ammonia	Albuminoid ammonia	Nitrites	Nitrates	Oxygen consumed	Chlorine	Total	Alkalinity	Bacteria per c.c.; gelatin 20°, 48 hours	10 c.c.	1 c.c.	1-10 c.c.
Liberty........	Sullivan.......	Tap, public supply..........	8/12/08	3	3	....	....	27	....	....	.010	.096	Tr.	0.04	2.65	1.00	9.5	3.0	1,250	+	+	—
Liberty........	Sullivan.......	Tap, public supply..........	1/16/11	15	Tr.	....	....	20	3	17	.006	.106	.004	0.20	2.95	1.25	12.7	6.0	500	+	+	—
Liberty........	Sullivan.......	Tap, public supply..........	10/28/11	15	5	....	....	39	20	19	.020	.082	Tr.	0.10	3.60	2.50	15.6	5.0	220	+	+	—
Liberty........	Sullivan.......	Tap, public supply..........	1/27/12	5	Tr.	....	....	28	10	18	.016	.052	.001	0.36	2.00	1.50	11.1	4.0	40	—	—	—
Liberty........	Sullivan.......	Tap, public supply..........	10/ 9/12	15	Tr.	....	....	40	10	30	.006	.092	Tr.	0.04	2.50	1.25	15.6	5.0	80	+	—	—
Liberty........	Sullivan.......	Tap, public supply..........	11/13/12	20	5	....	....	32	12	20	.032	.086	.001	0.06	4.20	1.75	16.9	5.0	120	+	+	—
Liberty........	Sullivan.......	Tap, public supply..........	1/ 1/13	15	Tr.	....	....	38	....	....	.024	.064	.001	0.20	2.70	1.75	16.9	4.0	140	+	—	—
Liberty........	Sullivan.......	Tap, public supply..........	2/ 5/13	10	Tr.	....	....	37	....	....	.010	.052	Tr.	0.08	2.30	1.37	12.7	2.0	30	—	—	—
Liberty........	Sullivan.......	Tap, public supply..........	3/23/13	5	5	....	....	38	....	....	.032	.098	Tr.	0.12	3.10	0.50	12.7	3.0	5,700	+	—	—
Liberty........	Sullivan.......	Tap, public supply..........	4/24/13	10	Cl.	....	....	32	....	....	.012	.032	Tr.	0.04	1.60	0.75	12.7	4.0	40	—	—	—
Liberty........	Sullivan.......	Tap, public supply..........	6/ 5/13	13	Tr.	....	....	34	....	....	.004	.056	Tr.	0.04	3.00	0.75	11.1	5.0	800	+	—	—
Liberty........	Sullivan.......	Tap, public supply..........	7/17/13	10	3	....	....	43	....	....	.010	.104	Tr.	0.04	1.10	1.50	14.3	6.0	140	—	—	—
Liberty........	Sullivan.......	Tap, public supply..........	4/ 1/15	8	1	1 v.	1 v.	24	9	15	.020	.058	Tr.	0.10	2.90	0.50	9.5	2.0	2,800	3+0—	1+2—	0+3—
Liberty........	Sullivan.......	Tap, public supply..........	7/26/15	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	180	3+0—	3+0—	2+1—
Liberty........	Sullivan.......	Darbee brook..............	7/26/15	6	Tr.	2 v.	2 v.	52	33	19	.008	.098	Tr.	0.08	4.60	1.25	9.5	1.0	1,500	3+0—	3+0—	0+3—
Liberty........	Sullivan.......	Revanah lake..............	7/26/15	5	Tr.	1 v.	1 v.	57	14	43	.008	.032	Tr.	0.08	2.70	0.75	15.6	6.0	20	3+0—	1+2—	0+3—

LILY DALE

HERMANN M. BIGGS, M.D., *State Commissioner of Health:*

An investigation of the public water supply of Lily Dale was made by Mr. C. M. Baker, assistant engineer, on July 1, 1915.

Lily Dale is located in Chautauqua county on the shores of the Canadaga lakes about nine miles south of the city of Dunkirk. It is reached over the Dunkirk, Allegany Valley and Pittsburg railroad from Dunkirk. The village consists of a spiritualist colony and is controlled by the Lily Dale assembly. The population during the winter is only 150 or 200 but during the summer averages about 1,500 and at times there are as many as 3,500 present on the grounds.

The water supply is controlled by the corporation and is pumped from one of the Canadaga lakes known as the Upper lake. Practically all of the population is served with the water but since its quality is considered unsatisfactory by the members of the assembly, wells are depended upon to supply the water for drinking and culinary purposes. There are 220 houses in the colony all of which are supplied with water from the general supply. None of the service taps are metered and little definite information could be obtained regarding the water consumption. The pressure due to the elevation of the water in the standpipe is approximately 25 pounds per square inch.

The pumping plant is located on the bank of the lake in the northern portion of the village. The intake consists of a 6-inch pipe extending about 25 feet into the lake. The end of this pipe is at a depth of about 4 feet and is unprotected by crib or other structure. Water is forced to the standpipes by a Worthington duplex double acting pump having a capacity of about 200 gallons per minute. Power is furnished by a 50 horsepower steam engine which also operates an electric lighting plant. There are two standpipes, one located on the assembly grounds proper with a capacity of 7,500 gallons and the other located at one of the hotels with a capacity of about 4,500 gallons. They are constructed of wood. Water is conveyed from the standpipes to the consumers by about two and one-half miles of water mains ranging in size from two to six inches in diameter.

The watershed that drains into the lake has an area of about four square miles, the main inlet entering the lake from the east. There are about 22 houses on the watershed and the population is approximately 110, an equivalent of 28 people per square mile exclusive of the inhabitants at the village.

The inspection of this watershed indicated that the buildings are located some distance from the watercourses and that there is little opportunity for pollution of the supply from this source. The most serious condition in reference to the quality of the water in the lake is the insanitary method of sewage disposal at the colony. Five cesspools loosely constructed of planks receive the sewage from the houses. Each cesspool is provided with an overflow discharging directly into the lake. All of these cesspools discharge into the lake about 30 feet from the water's edge and along the west shore not a great distance from the intake of the water supply, the nearest one being about 500 feet distant.

As stated above, wells are depended upon to furnish water for drinking and culinary purposes. Samples of water were collected from three of these wells, one located on the assembly ground; one in the hotel and one in a bakery. They are all driven wells about 30 feet deep and are provided with common pitcher pumps. They are undoubtedly subject to pollution from leaching cesspools and from leaky sewers. In some cases the cesspools are only about 100 feet distance from the wells.

Samples of water collected from the lake supply and from the three wells were sent to the Division of Laboratories and Research for analyses, the results of which will be found in the appended table.

The results of the analyses of the lake water show that it was slightly

turbid but that otherwise its appearance was satisfactory at the time of the inspection. Organic matter in the form of free and albuminoid ammonia was present in moderate amounts although the chlorine content of 2.5 parts per million is considerably above the normal for this locality. The water is moderate in hardness. The bacterial content of 500 per cubic centimeter is moderate although the presence of the colon bacillus in quantities of samples as small as 1 c. c. indicate active contamination of the supply by animal or human excreta. The analyses of the water taken from the various wells show in all cases pollution. This is indicated by the high chlorine contents which range from five to thirty-eight parts per million and although in two of the wells the contamination was not active at the time the sample was collected the presence of B. coli in the other shows active contamination.

It is apparent from the insanitary conditions as indicated by this investigation and also from the analyses of the water that the water supply taken from the lake and also from the wells was unsatisfactory at the time of the inspection. It should further be pointed out, that this condition will doubtless become much more dangerous later in the summer when the population of the colony is greatly increased; because under these conditions the water supply from the lake will undoubtedly become very badly polluted and it is also quite probable that active contamination will then occur in many of the wells.

As the result of this investigation, I beg to offer the following conclusions:

1. That the lake water supply of Lily Dale is subject to serious contamination by

(a) The sewage which is discharged without adequate purification into the lake.

(b) Intermittent contamination by bathers, fishermen and boating parties in the vicinity of the intake.

(c) Indirect contamination from the inhabitants on the watershed in addition to those at the village.

2. That the results of analyses of samples of water from the wells examined show that they are polluted and that one of them was actively contaminated.

3. That due to the dense population in the vicinity of the wells and the insanitary method of sewage disposal similar conditions probably exist in other wells on the ground and that these conditions become much more serious during the summer when the population is greatly increased.

In view of these facts it is apparent that the corporation should provide an adequate and safe supply of water for the inhabitants of the colony and I, therefore, beg to offer the following recommendations, to be acted upon by the Lily Dale assembly without delay:

1. That in order to eliminate the direct contamination of the supply by the sewage of the community, sewerage and sewage disposal be provided for the assembly, the plans for which should be prepared by a competent sanitary engineer and submitted to this Department for approval as required by law. In no case should sewage or sewerage effluents be discharged into the Upper lake from which the water supply is derived.

2. That application be made to this Department for the enactment of Rules and Regulations for the sanitary protection of their supply.

3. That a suitable apparatus be installed for the constant and efficient sterilization of the supply with liquid chlorine.

4. That, when these improvements have been made and the supply rendered satisfactory from the sanitary standpoint, the well supplies be abandoned.

Respectfully submitted,

THEODORE HORTON,
Chief Engineer

ALBANY, N. Y., *August* 25, 1915

REPORT OF WATER ANALYSIS FOR LILY DALE

Source		Tap at post-office	Tap at hotel	Assembly ground	Hotel	Bakery
Collected on		July 1	July 1	July 1	July 1	July 1
Color		1	....	Trace	....	....
Turbidity		5	....	Cl.	....	....
Odor, cold		3v	....	2v	....	....
Odor, hot		3v	....	2v	....	....
Solids, total		100	....	237	....	....
Loss on ignition		33	....	35	....	....
Mineral residue		67	....	203	....	....
Ammonia, free		.004	....	.002	....	....
Ammonia, albuminoid		.140	....	.002	....	....
Nitrites		.008	....	Trace	....	....
Nitrates		.040	....	.040	....	....
Oxygen consumed		4.60	....	0.10	....	....
Chlorine		2.50	2.00	11.75	5.00	38.00
Hardness, total		55.70	....	162.80	....	....
Alkalinity		55.00	....	157.00	....	....
Bacteria per c.c.		500	60	100	35	100
B. coli type	10 c.c.	3+0—	1+2—	0+3—	2+1—	0+3—
	1 c.c.	2+1—	0+3—	0+3—	0+3—	0+3—
	1/10 c.c.	0+3—	0+3—	0+3—	0+3—	0+3—

Results are expressed in parts per million. + Present. — Absent.
Abbreviations used to describe odors of water: 0, none; 1, very faint; 2, faint; 3, distinct; 4, decided; 5, strong; 6, very strong; a, aromatic; d, disagreeable; e, earthy; f, fishy; g, grassy; m, musty; v, vegetable.

LITTLE FALLS

HERMANN M. BIGGS, M.D., *State Commissioner of Health:*

A reinspection of the public water supply of Little Falls was made on August 5 and September 22, 1915, by Dr. J. E. Clark, sanitary supervisor of District "E." A previous investigation of this supply was made by Prof. H. N. Ogden in 1911 in connection with his investigation of the sanitary condition of this city as affected by its public water supply. The report of Professor Ogden will be found on page 924 of the thirty-third annual report of this Department.

The water supply of Little Falls is derived from impounding reservoirs on Beaver and Spruce creeks, about 8 miles north of the city, and from springs located near the Beaver Creek reservoir. The water from these sources flows by gravity to a distribution reservoir about one mile north of the city. The waterworks system in general remains practically the same as described in the early report. The waterworks are owned and operated by the city.

The watershed tributary to the Beaver Creek reservoir is approximately 6.4 square miles in area and consists of gently rolling country sparsely inhabited. There are about 16 farmhouses upon this area, the majority of which are comparatively remote from the stream or its tributaries. The land is devoted to agriculture and the fields adjacent to the stream are used for pastures. Consequently there is considerable contamination of the stream from animal sources. There is also the possibility of intermittent or accidental contamination of human origin due to the presence of a resident population on the watershed and of transient visitors thereto.

The springs near the Beaver reservoir, which are known as the King springs, apparently supply a water of fair sanitary quality, although possibly subject to a small amount of contamination from cattle grazing in their vicinity.

The Spruce Creek supply is used only at such times as the amount of water derived from Beaver creek and the King springs is insufficient for the needs of the city. Upon this stream there are two reservoirs. One, known as Klondike reservoir, is located near the headwaters of the stream and serves for storage purposes; the other, known as Eaton pond, is located about one mile northeast of the Beaver reservoir and serves as an intake reservoir. Below

the Eaton reservoir is a small sand filter, which was overhauled this past summer. Little information, however, is available as to the efficiency of this filter.

The watershed area tributary to Eaton reservoir is about 36.5 square miles. This area is for the most part wild and very sparsely settled country. There are, however, several summer cottages located around the pond. Picnic parties and boating are allowed upon its shores and waters. Spruce creek flows through considerable swampy area and the water is highly colored. Klondike reservoir is practically free from sources of contamination. The watersheds of both Beaver creek and Spruce creek are protected by rules and regulations enacted by this Department in 1904.

From the outlet of Eaton pond a 20-inch pipe line leads down and joins with the main from the Beaver reservoir to the distribution reservoir north of the city. The water from King springs flows directly into the mains leading to the distribution reservoir.

The distribution reservoir is difficult to clean and contains a considerable amount of accumulated sediment. At the outlet of this reservoir there is a coke strainer, through which the water passes before it enters the mains of the city. The coke in this strainer was renewed two years ago.

The previous report pointed out that the water supply came from streams subject to a small amount of surface contamination and that, although the watershed was sparsely inhabited, several summer cottages existed close to the water's edge, from which contamination might be received. It was also pointed out that the filters which had been built afforded no protection against contamination. It was therefore recommended that special studies be made of the possibility of improving the present supply, that the present coke filter be abolished, and that a modern efficient filter be installed in the vicinity of the distribution reservoir.

From the report of Dr. Clark, it appears that the board of public works is considering the purchase of land upon the watersheds at certain points in order to reduce the possibility of contamination, that work is being carried on to improve the physical surroundings of the reservoir, and consideration is being given to the installation of a chlorine apparatus for sterilization of the supply.

At the time of his inspection Dr. Clark collected samples of water from a tap in the city and from the various reservoirs, and the results of the analyses of these samples, together with others made in the past by the Division of Laboratories and Research, will be found in the appended table.

These analyses show a colored, somewhat turbid and moderately hard water. The figures for nitrogen in its various forms and for oxygen consumed are moderately high and are consistent with conditions existing upon the watershed. The total bacterial counts are in most cases very high and fecal organisms of the B. coli type are moderately prevalent, indicating a certain amount of active contamination of animal or human origin.

In view of the above facts, the following conclusions may be drawn:

1. That the city authorities of Little Falls have taken steps towards improving the sanitary and physical quality of the public water supply.

2. That the water supply of Little Falls derived from Beaver and Spruce creeks is open to a certain amount of contamination by surface wash from pasture land and from highways, and in the case of the Spruce Creek supply from summer cottages and picnic parties near and upon the waters of the Eaton reservoir.

3. That the physical quality of the water supply is depreciated by the comparatively high color, frequent turbidity and occasional growths of algae, these characteristics being due largely to the comparatively large amounts of organic matter derived from the swamp lands through which the streams flow.

I would therefore recommend:

1. That the city authorities install and operate suitable apparatus for the sterilization of the water supply with liquid chlorine, such apparatus to be installed at or below the outlet from the distribution reservoir.

2. That the city authorities give their careful attention to the desirability of subjecting the supply to treatment by a modern filtration plant in order to improve the physical and esthetic quality of the supply as well as its sanitary quality.

Respectfully submitted,

THEODORE HORTON,
Chief Engineer

ALBANY, N. Y., *December* 15, 1915

REPORT OF WATER ANALYSIS FOR LITTLE FALLS

Source	Tap, public supply					
Collected on	5/1/12	6/19/12	9/13/12	10/11/12	11/30/12	1/16/13
Color	15	8	30	15	10	10
Odor, hot	....	....	....	....	....	....
Odor, cold	....	....	....	....	....	....
Turbidity	10	12	15	15	2	Trace
Solids, total	102	130	130	141	152	94
Loss on ignition	22	15	19	10	22	....
Mineral residue	80	115	111	131	130	....
Ammonia, free	.008	.002	.002	.008	.004	.010
Ammonia, albuminoid	.084	.030	.072	.066	.050	.054
Nitrites	.001	.001	Trace	Trace	Trace	Trace
Nitrates	0.24	0.36	0.24	0.20	0.34	0.36
Oxygen consumed	2.60	1.70	4.70	3.20	2.00	2.00
Chlorine	0.25	0.50	0.12	0.75	0.25	0.75
Hardness, total	69	106	90	114	109	84
Alkalinity	68	103	78	110	107	83
Bacteria per c.c.	900	7,500	7,600	1,200	170	1,300
B. coli type, 10 c.c.	+	+	+	+	—	+
B. coli type, 1 c.c.	—	—	+	—	—	—
B. coli type, 1/10 c.c.	—	—	—	—	—	—

Results are expressed in parts per million. + Present. — Absent.

Abbreviations used to describe odors of water: 0, none; 1, very faint; 2, faint; 3, distinct; 4, decided; 5, strong; 6, very strong; a, aromatic; d, disagreeable; e, earthy; f, fishy; g, grassy; m, musty; v, vegetable.

REPORT OF WATER ANALYSIS FOR LITTLE FALLS

Source	Tap, public supply							
Collected on	5/8/13	6/13/13	12/1/13	5/6/14	8/5/15	8/5/15	8/5/15	9/22/15
Color	12	7	15	10	....	....	8	....
Odor, hot	....	....	....	1v	....	....	....	....
Odor, cold	....	....	....	1v	....	....	....	....
Turbidity	10	5	5	25	....	....	15	....
Solids, total	134	144	132	139	....	....	135	....
Loss on ignition	....	....	....	21	....	....	12	....
Mineral residue	....	....	....	118	....	....	123	....
Ammonia, free	.012	.008	.030	.008	....	....	.084	....
Ammonia, albuminoid	.046	.030	.080	.110	....	....	.098	....
Nitrites	.001	Trace	.001	Trace	....	....	.004	....
Nitrates	0.20	0.14	.024	0.24	....	....	0.80	....
Oxygen consumed	1.20	1.70	4.30	4.20	....	....	5.00	....
Chlorine	0.75	0.50	0.62	0.75	....	....	0.75	....
Hardness, total	106	97	94	86	....	....	120	....
Alkalinity	104	....	93	....	....	....	119	....
Bacteria per c.c.	170	80	950	1,600	1,100	1,000	7,800	46
B. coli type, 10 c.c.	+	+	+	+	3+0—	3+0—	3+0—	0+3—
B. coli type, 1 c.c.	—	—	—	—	3+0—	3+0—	3+0—	0+3—
B. coli type, 1/10 c.c.	—	—	—	—	1+2—	2+1—	3+0—	0+3—

Results are expressed in parts per million. + Present. — Absent.

Abbreviations used to describe odors of water: 0, none; 1, very faint; 2, faint; 3, distinct; 4, decided; 5, strong; 6, very strong; a, aromatic; d, disagreeable; e, earthy; f, fishy; g, grassy; m, musty; v, vegetable.

LIVONIA

HERMANN M. BIGGS, M.D., *State Commissioner of Health:*

An investigation of the public water supply of Livonia was made on September 8, 1915, by Mr. C. M. Baker, assistant engineer.

Livonia is an incorporated village of about 850 inhabitants, located in Livingston county on the Rochester branch of the Erie raiload about 25 miles south of the city of Rochester and near the lower end of Conesus lake.

The water supply for Livonia was originally pumped from Conesus lake by a private concern, which operated salt works in the vicinity. The operation of the salt works was discontinued, however, and it then became necessary for the village to operate this pumping plant. This was found rather expensive and was therefore abandoned and the present supply developed in 1911.

The present water supply is owned by the municipality and consists of wells and a pumping plant, located near the center of the village, from which the water is pumped to a reservoir located on a hill about one mile southeast of the village, whence it flows by gravity to the consumers. About 80 per cent. of the population is served with the water. There are a total of 225 service taps, all of which are metered. The average daily water consumption is approximately 20,000 gallons, an equivalent of 235 gallons per capita. The pressure in the village is 75 to 80 pounds per square inch.

The wells consist of a dug well, 14 feet in diameter and about 25 feet deep, and a 6-inch well drilled inside of this well to a depth of about 140 feet. The dug well is walled up with concrete blocks and covered by a concrete platform, on which is a building containing the deep well pump. A collecting tile, which extends about 150 feet southwest, collects ground water from a stratum of water bearing sand and gravel and conveys it into the dug well. The pumping station is located beside the wells and is equipped with a 7½ horsepower electric motor and a Rumsey triplex pump with a 5" x 8" cylinder and a capacity of approximately 4,000 gallons per hour. The reservoir is 60 feet in diameter and has a capacity of about one day's consumption, or 20,000 gallons. It is not covered. There is a total of about 6 miles of water mains ranging in size from 4 to 6 inches in diameter.

Within 500 feet of the wells are some 15 houses, 4 or 5 of which, however, are used for storage only. The population within the area is approximately 50 people. Beyond the 500-foot radius and within 1,000 feet of the wells the population is approximately 175, about 85 per cent. of which is at a greater elevation than the wells. In fact, it is probable that the natural flow of the ground water is such that the water which supplies the wells is derived almost entirely from the ground water which flows under the main part of the village, and is therefore subject to considerable pollution, especially in view of the present method of sewage disposal in the village, namely, cesspools, privies, etc. The extent to which this polluted ground water is purified during its passage through the soil depends upon the character of the soil, velocity of the ground water flow and various other hydraulic conditions.

The most serious source of contamination in the immediate vicinity of the wells is the overflow from a septic tank, which is discharged on the surface of the ground over the ground water collecting tile. This septic tank is located about 100 feet southwest of the wells in a concrete-block manufacturing establishment, in which 10 or 12 people are employed. The ground water collecting tile is about 4 or 5 feet below the surface of the ground. It passes by the side of the building and extends to a point about 20 feet south. The septic tank overflow is constructed of tile pipe. It passes over the collecting tile and terminates at the surface of the ground about 16 feet beyond. At the time of the inspection, however, there was no indication of any discharge at the outlet, as would be expected, since the septic tank receives the overflow from a drinking fountain in addition to the excreta. It seems probable therefore that the discharge from this septic tank leaks through the outlet pipe and thus percolates into the soil near or possibly directly over the ground

water collecting tile, and, since a tile pipe is seldom entirely watertight, it is probable that the supply receives considerable pollution from this source. At times there are a number of men working directly over the place from which the water is collected, and this may also be considered a menace to this source of supply. A building used for storing the concrete blocks is located only about 50 feet east of the wells and at an elevation 4 or 5 feet above them. Although there are no toilets at this place, there are at times a number of men working there, and unless proper sanitary precautions are rigidly observed at all times they may also cause pollution of the water supply.

Various samples of the water were collected and sent to the Division of Laboratories and Research for analyses, the results of which, together with those of previous analyses, are recorded in the appended table.

The results of the analyses indicate that the water is generally quite satisfactory in appearance, although the color was 10 in one sample and the turbidity 5. The average hardness of the water is excessive. The presence of considerable unoxidized organic matter is shown by the figures for free ammonia, which range from .008 to .336, and also by the figures for albuminoid ammonia, ranging from a trace to .040. The figures for nitrates are at times very high for a ground water in this vicinity, the maximum being 1.30. The chlorine is variable, ranging from 7.75 to 15 parts per million, but, in view of saline deposits which are known to exist in this locality, the chlorine content is unreliable or an indication of the sanitary quality of the water. The bacterial contents range from 40 to 1,900 per c. c. and are in general very high for a ground water. The B. coli type were also occasionally present, thus indicating at times active contamination.

In view of the difficulty attending the collection of the sample from the deep well, no reliance can be placed upon the bacterial results. The physical and chemical results do, however, show a very hard water with high turbidity, and with a large amount of nitrogenous matter present in the form of free ammonia and a high chlorine content. The high figures for free ammonia and chlorine may be due, however, to the presence of certain mineral constituents in the strata from which the supply is derived. In this connection it should be noted that salt wells exist in this vicinity. The high turbidity of this water has existed since the construction of the well, and in view of this fact the water from this source has not been turned into the general supply. The particles causing the turbidity were exceedingly small and give the water a milky appearance. Attempts have been made to eliminate this trouble by continuous pumping from the well, but up to the time of the inspection this result had not been accomplished.

The results of the analyses of the general supply indicate that it is receiving considerable pollution and that at times this pollution is active and possibly of a dangerous character, a condition in fact which might be anticipated from the insanitary conditions in the vicinity of the wells.

As a result of this investigation, the following conclusions may be drawn:

1. That the wells from which the public water supply of the village of Livonia is obtained are unfortunately located in the center of a comparatively densely populated district and that they are specifically subject to contamination from the overflow of a septic tank and possibly from fecal contamination of the ground by workmen in the vicinity.
2. That the supply from the shallow well is at times inadequate.
3. That the water obtained from the deep well is unsatisfactory, principally because of its high turbidity.

In view of the above, I beg to offer the following recommendations, to be acted upon by the village authorities:

1. That, in view of the unsatisfactory location of the wells from which the supply is derived, thus making it extremely difficult if not impossible to adequately protect them from contamination at all times, the village officials immediately take steps to secure and develop a new supply from a source free from pollution and satisfactory regarding both quantity and quality.
2. That, pending the development of the new supply, the following steps

be taken to minimize as far as possible the danger of contamination of the present supply:

(a) The discharge from the septic tank located in the concrete-block manufacturing establishment be conveyed in tight cast-iron pipes to a point at least 500 feet distant from the wells and there disposed of in a satisfactory manner.

(b) All cesspools and privies within a radius of 500 feet of the wells which are located at an elevation higher than the surface of the water in the dug well be eliminated or provided with watertight containers or otherwise made impervious, and that the contents from these containers be regularly disposed of in a sanitary manner.

(c) Regular sanitary inspections be frequently made of all premises within 500 feet of the wells and that rigid control be exercised over the sanitary conditions about these places.

(d) The supply now obtained from near the concrete-block manufacturing establishment by means of collecting tile be abandoned and the tile conveying it to the well be disconnected.

Respectfully submitted,

THEODORE HORTON,

Chief Engineer

ALBANY, N. Y., *November* 17, 1915

RESULTS OF WATER ANALYSES

Abbreviations used to describe odors of water: 0, none; 1, very faint; 2, faint; 3, distinct; 4, decided; 5, strong; 6, very strong; a, aromatic, d, disagreeable; e, earthy; f, fishy; g, grassy; m, musty; v, vegetable

Municipality	County	Source of sample	Date of collection	PHYSICAL				CHEMICAL (PARTS PER MILLION)												BACTERIOLOGICAL			
						ODOR		SOLIDS			NITROGEN AS—						HARDNESS				B. COLI TYPE + = PRESENT − = ABSENT		
				Color	Turbidity	Cold	Hot	Total	Loss on ignition	Mineral residue	Free ammonia	Albuminoid ammonia	Nitrites	Nitrates	Oxygen consumed	Chlorine	Total	Alkalinity	Bacteria per c.c.: gelatin 20°, 48 hours	10 c.c.	1 c.c.	1-10 c.c.
Livonia	Livingston	Tap, public supply	2/15/12	Tr.	5	....	....	339	32	307	.072	.014	.003	1.02	0.10	11.25	285.5	275.0	120	−	−	−
Livonia	Livingston	Tap, public supply	4/20/12	10	Tr.	....	....	319	11	308	.336	.022	.026	0.34	1.00	7.75	293.0	278.0	1,900	−	−	−
Livonia	Livingston	Tap, public supply	11/25/12	Tr.	Tr.	....	....	347	20	327	.008	.024	.001	1.00	0.30	13.25	300.0	280.0	1,500	+	−	−
Livonia	Livingston	Tap, public supply	1/30/13	Tr.	Cl	....	....	336	....	....	.020	.040	.002	1.30	0.60	13.37	257.0	363.0	40	−	−	−
Livonia	Livingston	Tap, public supply	4/30/13	3	2	....	....	358	....	....	.028	.036	.002	0.60	0.40	11.25	257.0	257.0	190	−	−	−
Livonia	Livingston	Tap, public supply	9/8/15	Tr.	Tr.	1 v.	1 v.	365	25	345	.008	Tr.	.003	0.80	2.80	15.00	300.0	271.0	475	+	−	−
Livonia	Livingston	Pump — Main or dug well	9/8/15	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	10,000	+	−	−
Livonia	Livingston	Deep well	9/8/15	Tr.	120	3 a.	3 a.	595	65	530	.910	.936	.005	0.60	9.00	5.00	300.0	295.0	....	....	....	....

LOCKPORT

HERMANN M. BIGGS, M.D., *State Commissioner of Health:*

A reinspection of the public water supply of Lockport was made in August, 1915, by Dr. Edward Clark, sanitary supervisor of District "O". A previous investigation of this supply was made in 1911 by Prof. H. N. Ogden in connection with his investigation of the sanitary condition of this city. The report of Professor Ogden will be found on page 901 of the thirty-second annual report of this Department.

The public water supply of the city of Lockport is derived from the Niagara river; the intake being about one-quarter of a mile from the east bank of the river close to the shore of Grand island. There are three water supply intakes in the river near this point, the upper one furnishing water to the city of Tonawanda, the middle one to North Tonawanda and the lower one to Lockport. These intakes are all practically in the same channel of the river. Water is brought from the Niagara river to Lockport in one 30-inch main; the pumping is done by three centrifugal pumps driven by electric power located in the pumping station at the river bank in North Tonawanda. The total capacity of the pumps for twenty-four hours is 17,000,000 gallons. These pumps are operated against a head maintained by a standpipe in Lockport. This standpipe is 126 feet high and 25 feet in diameter and holds approximately 500,000 gallons.

There are 37 miles of water mains ranging in size from 4 inches to 24 inches in diameter. There are about 4,400 service taps, about 2,700 of which are metered. The daily water consumption is approximately 2,400,000 gallons per day or about 130 gallons per capita.

Since the earlier report the city has installed apparatus for the sterilization of the supply with liquid chlorine. This apparatus was installed about July 1, 1914. This apparatus is of the type manufactured by the Electro-Reaching Gas Company of New York City. Chlorine is added at the rate of about six ounces per hour or 0.44 parts per million.

Prior to the installation of this apparatus there was an average of about sixty cases of typhoid fever in the city each year. From August 1, 1914, to August 1, 1915, fifteen cases only have occurred. Of these cases, one was clearly an imported case and five of the cases used well water instead of the city water.

The dangerous sanitary quality of the water supplies derived unpurified from the Niagara river is too well known to require extended description. The sewage of the city of Buffalo is discharged into this river and, although the dilution is high, the effect of this sewage upon the sanitary quality of the river is indicated clearly by the excessive typhoid fever death rates in the cities whose water supplies have been derived unpurified from this source.

At the time of the earlier investigation it was pointed out that the unpurified supply was unsafe for domestic purposes and it was recommended that the city take steps to provide filtration for the river water and that a sterilization plant for temporary use should be installed until such time as the filtration plant could be constructed.

From the report of Dr. Clark, it appears that the city has realized the unsatisfactory quality of their supply and the installation of the sterilization apparatus is a step towards improving its quality.

Subsequent to the time of his inspection, Dr. Clark collected samples of raw and treated water and the results of the analyses of these samples together with others made in the past by the Division of Laboratories and Research will be found in the appended table.

These analyses show clearly the decidedly unsatisfactory and unsafe quality of the untreated Niagara river water. The bacterial analyses show high total counts and the occurrence of organisms of the B. coli type in samples as small as 1/10 c. c. The analyses of samples of sterilized water show a marked improvement in this respect. The high bacterial counts in the

samples of September 13, 1915, are undoubtedly due to multiplication in transit caused by the melting of the ice in the containers before the samples reached the Laboratory.

In view of the above facts the following conclusions may be drawn:

1. That the city of Lockport has carried out in part the previous recommendations of this Department in having installed apparatus for the sterilization of the water supply.
2. That the former use of unpurified Niagara river water as a public supply, as previously pointed out and now clearly verified, was the primary cause for the continued excessive typhoid fever in the city in the past.
3. That the installation and operation of the sterilization plant has apparently brought about a marked and gratifying reduction in the typhoid fever in Lockport.
4. That the intensive character of the contamination in the river water and the difficulty of satisfactorily treating this water at all times with liquid chlorine render it desirable to secure an additional safeguard by the installation of a filtration plant, as recommended in the previous report.

I would, therefore, recommend:

1. That the city authorities maintain a continuous and careful operation of the sterilization apparatus for their public water supply.
2. That the city have regular and frequent bacteriological analyses made of the raw and treated water in order to determine and properly control the efficiency of the process at all times.
3. That, at an early date, the city authorities give their careful consideration to the advisability of installing a modern filtration plant, retaining the chlorine sterilization apparatus for supplementary treatment.

Respectfully submitted,
THEODORE HORTON,
Chief Engineer

ALBANY, N. Y. *November* 30, 1915

RESULTS OF WATER ANALYSES

Abbreviations used to describe odors of water: 0, none; 1, very faint; 2, faint; 3, distinct; 4, decided; 5, string; 6, very strong; a, aromatic, d, disagreeable; e, earthy; f, fishy; g, grassy; m, musty; v, vegetable

Municipality	County	Source of sample	Date of collection	Physical: Color	Physical: Turbidity	Odor: Cold	Odor: Hot	Chemical (Parts per Million) Solids: Total	Solids: Loss on ignition	Solids: Mineral residue	Nitrogen as— Free ammonia	Nitrogen as— Albuminoid ammonia	Nitrogen as— Nitrites	Nitrogen as— Nitrates	Oxygen consumed	Chlorine	Hardness: Total	Hardness: Alkalinity	Bacteriological: Bacteria per c.c.; gelatin 20°, 48 hours	B. Coli Type (+ = present, — = absent): 10 c.c.	1 c.c.	1-10 c.c.
Lockport	Niagara	Tap, public supply	1/24/12	5	15	....	....	154	28	126	.012	.064	.002	.008	1.37	8.0	103	99	150	+	—	—
Lockport	Niagara	Tap, public supply	3/18/12	10	5	....	....	148	23	125	.014	.067	Tr.	.008	0.80	7.5	111	97	70	+	—	—
Lockport	Niagara	Tap, public supply	4/20/12	10	10	....	....	149	17	132	.004	.018	.001	.006	1.40	7.5	94	91	500	+	—	—
Lockport	Niagara	Tap, public supply	8/30/12	5	8	....	....	176	22	154	.002	.082	Tr.	.006	2.10	7.0	96	93	100	+	+	—
Lockport	Niagara	Tap, public supply	9/19/12	5	Tr.	....	....	162	33	129	.008	.072	.002	.004	1.10	7.0	100	94	10,500	+	+	—
Lockport	Niagara	Tap, public supply	10/ 8/12	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	140	+	+	—
Lockport	Niagara	Tap, public supply	10/15/12	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	450	+	—	—
Lockport	Niagara	Tap, public supply	11/22/12	5	Tr.	....	....	140	28	112	.008	.080	Tr.	.004	1.30	7.0	106	92	350	+	—	—
Lockport	Niagara	Tap, public supply	1/ 9/13	5	10	....	....	150	....	....	.016	.088	.003	0.10	1.60	7.9	100	97	210	+	—	—
Lockport	Niagara	Tap, public supply	2/ 7/13	5	50	....	....	163	17	146	.006	.076	Tr.	0.10	2.90	7.5	106	98	800	+	+	—
Lockport	Niagara	Tap, public supply	2/28/13	10	10	....	....	140	....	....	.008	.064	Tr.	0.06	0.80	7.5	100	97	100	+	+	—
Lockport	Niagara	Tap, public supply	4/10/13	2	20	....	....	152	....	....	.016	.074	.001	0.10	1.40	6.3	94	81	700	—	—	—
Lockport	Niagara	Tap, public supply	5/29/13	5	3	....	....	134	....	....	.016	.052	.001	0.04	1.30	7.8	100	91	650	—	—	—
Lockport	Niagara	Tap, public supply	7/17/13	5	7	....	....	144	....	....	.008	.082	Tr.	0.02	1.80	7.8	94	92	37,500	+	+	+
Lockport	Niagara	Tap, public supply	4/21/14	Tr.	15	1 v.	1 v.	148	24	124	.022	.086	.001	0.10	2.10	7.3	93	87	300	+	+	+
Lockport	Niagara	Tap, chlorinated water	2/23/15	5	2	1 v.	1 v.	129	11	118	.004	.036	.003	0.10	3.00	8.3	100	94	15	—	—	—
Lockport	Niagara	Tap, chlorinated water	5/10/15	Tr.	8	2 a.	2 a.	120	10	110	.002	.052	.003	0.10	2.10	8.0	94	94	20	—	—	—
Lockport	Niagara	Tap, chlorinated water	5/10/15	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	10	—	—	—
Lockport	Niagara	Tap, chlorinated water	5/10/15	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	30	—	—	—
Lockport	Niagara	Tap, chlorinated water	5/10/15	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	20	+	—	—
Lockport	Niagara	Intake, raw water	8/26/15	2	3	1 v.	1 v.	170	25	145	.034	.050	.003	0.10	2.60	8.5	94	92	....	....	....	....
Lockport	Niagara	Tap, chlorinated water	8/26/15	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	10	—	—	—
Lockport	Niagara	Tap, raw water	9/13/15	Tr.	Cl.	1 v.	1 v.	162	55	107	.002	.040	.002	.060	4.00	8.3	94	92	*1,000	—	—	—
Lockport	Niagara	Tap, chlorinated water	9/13/15	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	*5,900	—	—	—
Lockport	Niagara	Tap, chlorinated water	9/13/15	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	*350	—	—	—

* Ice melted.

LONG BEACH

HERMANN M. BIGGS, M.D., *State Commissioner of Health:*

An investigation of the public water supply of Long Beach, L. I., was made on October 1, 1915, by Mr. C. M. Baker, assistant engineer.

Long Beach is situated on the south shore of Long Island in the town of Hempstead, Nassau county. It is on the Long Beach branch of the Long Island railroad, twenty-five miles from New York City. The water supply, however, is obtained from wells located near Lynbrook about five miles north. The resident population of Long Beach is about 400, but this is increased to about 2,500 during the summer months.

The water supply is owned and controlled by the Long Beach Water Company, of which S. M. Bard of New York City is president. Water is pumped from a well located near Lynbrook into a standpipe located at Long Beach whence it is distributed by gravity to the consumers. The entire population is served with the public water supply. The water consumption is approximately 400,000 gallons daily during the winter and about 1,200,000 in the summer. The average pressure is about 60 pounds per square inch.

The well from which the water is derived is 11 feet in diameter and is dug to a depth of 80 feet through strata of sand and gravel. It is enclosed with a metal casing which extends to the surface. Fifty feet from the surface a concrete floor is constructed on which rests the pumps. The normal depth of water in the well is about 30 feet. The pumping equipment at the time of the inspection consisted of two turbine pumps each having a capacity of 80,000 gallons per hour and operated by induction motors. Improvements, however, were being made at the time of the inspection and when completed steam power will be furnished. The standpipe is 34 feet in diameter and 150 feet high and has a capacity of approximately 1,000,000 gallons. There is a total of 12 or 13 miles of water mains ranging in size from 3 to 24 inches in diameter. The main leading from the pumping station to the standpipe is a 24-inch pipe.

The water company owns about three and one-half acres of land in the vicinity of the plant and there are few buildings in the locality, the nearest house being about 200 feet distant. The privy located at the pumping plant is about 75 feet from the well and is provided with a shallow wooden oil barrel for a container. It was in a satisfactory condition at the time of the inspection.

Samples of water were later collected from taps at Long Beach by Dr. T. M. Johnson and sent to the Division of Laboratories and Research for analyses, the results being appended.

The results of the analyses show the presence of a moderate amount of organic matter as indicated by the figures for albuminoid and free ammonia and nitrates. The bacterial count was low except in one case, which was possibly due to delay of the sample in transit. The B. coli type was not found present.

As a result of this investigation it is apparent that the water supply of Long Beach was in a satisfactory condition at the time of the investigation and that, providing proper sanitary conditions are at all times maintained in the vicinity of the plant, a satisfactory supply of water of sanitary quality should be obtained. It should be pointed out, however, that great precaution should be at all times taken to maintain the privy at the pumping station in the most sanitary condition possible.

In view of the above I beg to offer the following recommendations to be acted upon by the water company:

1. That a watertight metal container be provided for the privy instead of the present wooden one and that great care be exercised to maintain this privy in a proper sanitary condition at all times.

2. That, should other buildings be constructed in the vicinity of the plant in the future, care be taken that the sewage from them be disposed

of in a proper sanitary manner so that there will be no possible pollution of the water supply. In this connection it may be stated that no leaching cesspool or earth vault privy should be located within 500 feet of the well.

3. That analyses of the water be occasionally made during the year to detect the presence of any active contamination which may occur.

4. That, should such contamination be at any time present,

(a) Steps be immediately taken to determine and eliminate the source of pollution, or

(b) The supply be sterilized with liquid chlorine or some other equivalent method.

Respectfully submitted,

THEODORE HORTON,
Chief Engineer

ALBANY, N. Y., *December 29*, 1915

REPORT OF WATER ANALYSIS FOR LONG BEACH

Source	Tap at Hotel Nassau, "A"	Tap in village	Tap, Hotel Lafayette, "B"
Collected on	10 19 15	10 19 15	10 19 15
Color	Trace	....	....
Odor, hot	1v	....	....
Odor, cold	1v	....	....
Turbidity	Trace	....	....
Solids, total	86	....	....
Loss on ignition	29	....	....
Mineral residue	57	....	....
Ammonia, free	.008	....	....
Ammonia, albuminoid	.008	....	....
Nitrites	Trace	....	....
Nitrates	1.30	....	....
Oxygen consumed	2.65	....	....
Chlorine	11.38	....	....
Hardness, total	32.50	....	....
Alkalinity	8.00	....	....
Bacteria per c.c.	500	10	60
B. coli type, 10 c.c.	0+3—	0+3—	0+3—
B. coli type, 1 c.c.	0+3—	0+3—	0+3—
B. coli type, 1/10 c.c.	0+3—	0+3—	0+3—

Results are expressed in parts per million. + Present. — Absent.
Abbreviations used to describe odors of water: 0, none; 1, very faint; 2, faint; 3, distinct; 4, decided; 5, strong; 6, very strong; a, aromatic; d, disagreeable; e, earthy; f, fishy; g, grassy; m, musty; v, vegetable.

LONG EDDY

HERMANN M. BIGGS, M.D., *State Commissioner of Health:*

An inspection of the public water supply of Long Eddy was made on July 28, 1915, by Mr. E. S. Chase, assistant engineer, accompanied and aided by Dr. S. C. Schonger, health officer.

Long Eddy is an unincorporated village with a population of approximately 375. It is located in the southwestern part of Sullivan county, on the Delaware river and the Erie railroad. The water supply is derived from Pea brook, a small stream tributary to the Delaware river. The intake is located about three-fourths of a mile north of the center of the village. The water works were constructed in 1890 by the Long Eddy Water Company who own and operate the system at present.

Approximately 200 people are supplied with the water or about 65 per cent. of the population. No information is available relative to the water consumption. The water is distributed by gravity through one and one-quarter

miles of water mains ranging in size from two to six inches in diameter. There are 40 service taps in the village none of which are metered.

The intake is formed by a small timber dam across the stream. Numerous one-inch holes in a wooden bulkhead admit the water to a small wooden box from which an eight-inch cast-iron pipe leads to a small storage reservoir. This reservoir is located a few hundred feet below the intake and is formed by a low masonry dam. This reservoir is approximately 30 feet wide and 100 feet long and is only four or five feet deep in its deepest part. The intake pipe enters the upper end of the reservoir but the water is carried from this end through a wooden flume to a point near the intake to the village main. At the time of the inspection the reservoir was partly covered with algae growth. It is said that the reservoir has never been cleaned nor have the water mains been flushed. Numerous complaints have been made in respect to the quality of the water and at times eels have been found in the service pipes, showing that the intakes are improperly protected.

The watershed tributary to the intake is approximately four square miles in area. The total population upon this watershed may be estimated at about 75 or 20 per square mile. This area is a narrow valley bounded by high side hills, rocky, and covered with woods. The upper part is less precipitous and the valley wider. The soil is gravel over shale and the run-off is very rapid. There are several abandoned quarries upon this area which at one time were extensively worked and at present there is some lumbering and farming.

There are about fifteen houses, one church, a schoolhouse, a butter factory and a sawmill located along the highway which parallels closely the course of the brook. In addition to possible indirect contamination from these sources there are opportunities for contamination from highway wash and run-off from cultivated and pasture lands, and also opportunities for direct contamination from human origin at various points on the watershed. About one-eighth of a mile above the intake there is a house and barn on a steep slope from which surface wash may quickly reach the stream. The privy at this place is on a steep bank about 75 feet from the stream. About one mile above the intake there is a vacant house, the privy of which is about 15 feet from the edge of the stream. A short distance above this house is an occupied house the privy of which is about 25 feet from the stream and a sink drain empties upon its bank. Approximately two miles above the intake there is an occupied house with a privy a few feet from the bank of the stream. A small settlement in which there are several houses, school, church and mill, is located about three miles above the intake. The mill is directly on the bank of the stream but the majority of the houses are fairly distant.

At the time of the inspection samples of the water were collected from a tap in the village and analyses of these samples together with others made in the past by the Division of Laboratories and Research will be found in the appended table.

These analyses show a soft water somewhat colored and occasionally turbid. The figures for decomposing and decomposable organic matter are moderate although the chlorine content is usually above normal for this region. In most cases the total bacterial counts are excessive and fecal organisms of the B. coli type are always present in ten c.c., frequently in one c.c. and occasionally in one-tenth c.c., indicating the occurrence of active contamination of animal or human origin.

In view of the above facts the following conclusions may be drawn:

1. That the public water supply of Long Eddy is not of an entirely satisfactory esthetic quality due to the occasional occurrences of turbidity caused by heavy rainfall and of disagreeable tastes and odors, caused by algae growths in the reservoir.

2. That the supply is of a somewhat insanitary quality due to the numerous opportunities for indirect contamination and to the certain opportunities for direct contamination from privies, highway wash and general run-off from a populated watershed.

I would therefore recommend:

1. That the water company clean the distribution reservoir to prevent algae growths as far as possible. The intakes should also be more adequately protected by screens or strainers.

2. That the company make a careful and thorough inspection of the watershed from which the supply is derived in order to determine and correct all sources of direct contamination of the stream.

3. That, in case the company experience any difficulty in the carrying out of the above recommendation, it should apply to this Department for the enactment of rules and regulations for the sanitary protection of the supply.

4. That, in case it is found impracticable to control the sources of contamination of the water by such measures, the water company abandon its present supply and develop a new supply satisfactory in quality and adequate in quantity.

Respectfully submitted,

THEODORE HORTON,
Chief Engineer

ALBANY, N. Y., *September* 10, 1915

(b) By connecting all buildings in the vicinity with the sewers by means of cast-iron pipes with tight joints, and discharging all sewage into the general sewerage system, as soon as the proposed sewerage system is completed and ready for use.

2. That analyses of the water be occasionally made during the year to determine whether the above improvements have rendered the supply satisfactory and whether active contamination at any time occurs.

3. That should the analyses at any time indicate pollution steps be immediately taken

(a) To determine and eliminate the source of pollution if possible; or

(b) To purify the supply or sterilize the water by the use of liquid chlorine; and

(c) Should the above improvements fail to render the supply satisfactory in quality new wells or other supply should be obtained which are not subject to pollution.

Respectfully submitted,

THEODORE HORTON,
Chief Engineer

ALBANY, N. Y., *July* 13, 1915

MARGARETVILLE

HERMANN M. BIGGS, M.D., *State Commissioner of Health:*

A reinspection of the public water supply of Margaretville was made on August 18, 1915, by Dr. C. C. Duryee, sanitary supervisor of District "C". A previous investigation of this supply was made in 1909 by the Engineering Division, a report of which will be found on page 308, volume II of the thirtieth annual report of this Department.

The public water supply of Margaretville is derived from Scott brook about three-quarters of a mile north of the village. Since the earlier report a new reservoir has been constructed about one-eighth of a mile below the one in existence at that time. This reservoir is of concrete construction 25 by 50 feet in plan by 10 feet deep, covered by a metal roof. There are two sources of supply which feed this reservoir. The first supply consists of two small spring fed brooks and a spring which will lead into a small collecting box and thence into the reservoir. The second supply is taken from Bull Run brook at two different points. The first point is a short distance above the new reservoir and the other is about 200 feet above the old reservoir. From this point above the old reservoir there is a 4-inch pipe which carries the water to the new reservoir where it empties into the reservoir through what is termed a top filter. This filter is a concrete basin about 4 feet by 4 feet in plan, 2 feet from the top of which is an 8-inch layer of gravel with a covering of brasswire netting, 14 meshes to the inch, reinforced by a perforated steel plate. The water enters the lower part of this filter and forces itself through the gravel and thence into the reservoir. The lower portion of the filter is so arranged that it may be flushed out through an overflow pipe.

The condition of the watershed above the old dam is practically the same as described in the earlier report. The house spoken of as located just above the old reservoir does not have its drainage below the reservoir but directly into the brook crossing a small pasture about one-half acre in extent. The privy at this house is about 150 feet from the brook and is of the ordinary rural type. The privy on the Robert Scott property referred to in the earlier report has been rebuilt and provisions have been made for the removal of the contents and, if properly cared for, need not be a source of contamination. At the Bertha Sanford farm, about three-quarters of a mile above the dam, the privy is in the same condition as at the time of the previous investigation.

A third source of supply is from driven wells 26 feet deep, five in number, with 1½-inch pipe. These wells are located in the village and are used only through the summer and in case of emergency. The pumping equipment consists of a Gould pump with a capacity of sixty gallons per minute driven 10-horse power gasoline engine located in a concrete pump house.

At the time of the earlier inspection the insanitary conditions upon the watershed were clearly pointed out and it was recommended:

1. That a thorough inspection of the watershed of Scott brook and its tributaries should be made and steps taken to remove all existing sources of pollution of the supply and to guard against their recurrence in the future.

2. That in case any difficulty is experienced in removing the sources of pollution of the watershed the water company should consider the question of application to this Department for the enactment of rules and regulations for the protection of the water supply.

From the report of Dr. Duryee it appears that the water company has taken steps toward carrying out the recommendations of this Department although no application has been received for the enactment of rules and regulations.

At the time of his inspection Dr. Duryee collected samples of water and the results of the analyses of these samples will be found in the appended table.

These analyses show a water of moderate color and with moderate amounts of decomposing and decomposable organic matter. The total bacterial count is very high and the organisms of the B. coli type were found in samples as small as 1/10 c.c. It should be noted, however, that the containers in which these samples were sent were not properly iced and, furthermore, that the samples were three days in reaching the laboratory.

In view of the above facts the following conclusions may be drawn:

1. That the Margaretville Water Company has carried out to a certain extent the recommendations of the previous report, although there still remain conditions upon the watershed which require improvement. Furthermore, no application has been made to this Department for the enactment of rules and regulations.

2. That the water supply of Margaretville is open to intermittent contamination from surface wash, from cultivated lands, from highways, from the vicinity of farm buildings and, in some cases, from privies.

3. That while it is impossible to arrive at any definite conclusion regarding the sanitary quality of the water derived from the auxiliary well supply without more exact information regarding its sanitary surroundings and without analytical results of a series of samples, it may be stated on general principles that the location of wells in a thickly settled community renders them open to contamination by leachings from privy vaults, cesspools and leaky sewers.

In view of the above I would, therefore, recommend:

1. That the Margaretville Water Company take immediate steps to remove all sources of contamination pointed out in detail in the body of this report.

2. That in case any difficulty is experienced in carrying out the above recommendation, the water company should consider an application to this Department for the enactment of rules and regulations for the sanitary protection of the water supply.

3. That in case it is found impracticable or impossible to effectually remove all sources of contamination the water supply be sterilized by the use of liquid chlorine.

4. That the water company take every precaution to detect and prevent any contamination of the auxiliary well supply. Whenever this supply is used analyses should be made to secure evidence as to its sanitary quality and in case analyses show contamination, steps should be taken to remove the sources of such pollution or to secure a new auxiliary supply of unquestionable sanitary quality.

Respectfully submitted,

THEODORE HORTON,

Chief Engineer

ALBANY, N. Y., *November* 3, 1915

REPORT OF WATER ANALYSIS FOR MARGARETVILLE

Source		Reservoir	Tap, public supply
Collected on		8/27/15	8/27/15
Color		5	....
Odor, hot		1v	....
Odor, cold		1v	....
Turbidity		Trace	....
Solids, total		62	....
Loss on ignition		40	....
Mineral residue		22	....
Ammonia, free		.006	....
Ammonia, albuminoid		.062	....
Nitrites		.003	....
Nitrates		1.60	....
Oxygen consumed		3.90	....
Chlorine		0.50	....
Hardness, total		16.9	....
Alkalinity		11.0	....
Bacteria per c.c		*25,000	*37,000
B. coli type	10 c.c.	3+0—	3+0—
	1 c.c.	2+0—	3+0—
	1/10 c.c.	3+1—	1+2—

* Three days in transit and not iced.
Results are expressed in parts per million. + Present. — Absent.
Abbreviations used to describe odors of water: 0, none; 1, very faint; 2, faint; 3, distinct; 4, decided; 5, strong; 6, very strong; a, aromatic; d, disagreeable; e, earthy; f, fishy; g, grassy; m, musty; v, vegetable.

MARION

HERMANN M. BIGGS, M.D., *State Commissioner of Health:*

An inspection of the public water supply of the village of Marion was made on September 7, 1915, by Mr. Morton F. Sanborn, assistant engineer. The inspector was assisted at the time of the inspection by Mr. Charles H. Lockup, president of the water district, Mr. Charles L. Saybolt, treasurer, and Mr. William Howell, secretary and superintendent.

Marion is an unincorporated village in the southern part of the town of Marion near the western part of Wayne county. It is about twenty-five miles east of Rochester and ten miles from Lake Ontario and is the terminal of the Newark and Marion railroad. The population of the village at the time of the inspection was about 800.

The public water supply is furnished by the Marion Water Works which supplies the water district and is a municipal organization. The water is used for household purposes and for fire protection. The works were designed by H. C. Ketridge, civil engineer, of Rochester, and were constructed by Mr. Charles Lewis in the fall of 1913 under the direction of Mr. Ketridge.

The water is obtained from a spring or well located one and one quarter miles south of the village and about 50 feet from and somewhat below the highway. From this well the water is pumped at a nearby pumping station to the mains and reservoir which is located on a hill somewhat nearer the village. About 300 of the population which corresponds to 37 per cent. of the total population are served by this water supply. It was estimated from the meter readings that the daily consumption amounts to 20,000 gallons, which is equivalent to 70 gallons per capita per day. There are approximately four miles of water mains ranging in size from 6 to 8 inches in diameter. Of the 300 houses in the water district, 75 are served by the water supply and nearly all of the services are metered. The average pressure in the village is about 65 pounds.

There is no sewer system or method of sewage disposal in the village except cesspools and septic tanks.

The well from which the water supply is obtained in about 30 feet in diameter and 15 feet deep, and was sunk at the location of a large spring. The well acts as a small collecting basin from which the water is pumped

at intervals to the distributing system and reservoir. Concrete walls extend about 30 feet from each side of the well to act as a cut-off in order to intercept the ground water flow for collection in the well. At the time of the inspection the water in the well was about 11 feet deep and the quantity of water amounted to about 58,000 gallons.

The pumping station is located between the road and the well, and is a concrete building 22 feet by 14 feet in size. The pumping machinery consists of one Rumsey, triplex plunger pump having 6-inch diameters and an 8-inch stroke. This pump is operated by a 15-horse power Fairbanks Electric Motor. The pumping plant is rated at a capacity of 170 gallons per minute. The pump is usually operated a few hours each day in order that the water in the reservoir might be maintained at a fairly constant elevation.

The reservoir is located on a hill about three-fourths of a mile south of the village and is constructed of concrete. It is 60 feet in diameter and is 13 feet deep at the center and eight feet deep at the side. A timber roof covers the reservoir and entrance is obtained through a trap door which is kept locked. The capacity of the reservoir is about 183,000 gallons which corresponds to a little over a week's supply. The reservoir had not been cleaned previous to the inspection although it was cleaned shortly after. The water mains are flushed out two or three times a year.

The spring has a small surface watershed although the area from which water might be drawn at the elevation of the spring is approximately one-quarter of a square mile. There are no houses directly above the spring although there is one house on the highway about 75 feet north of the spring and another about 140 feet south. In general the drainage from these houses would flow across the road into a nearby brook and not towards the well. The field on the other side of the road is used as a pasture. It is possible, however, that some drainage from the two houses as well as drainage from the road and pasture may reach the wells.

The amount of water obtained from this well at times of drought has been insufficient to supply the needs of the district and the Conservation Commission has recently approved an application of the water district to increase the supply by obtaining water from a well which is located in a sand and gravel bank at the foot of the hill to the north of the reservoir. There are no houses above this proposed supply and a well 15 feet square and 16 feet deep has been constructed of concrete. It is proposed to install a five-inch diameter, six-inch stroke Gould triplex plunger pump which will be operated by an electric motor or by a gasoline engine.

At this time of the inspection a sample of the water was obtained from a tap in the village and the results of the analyses together with analyses of samples taken on October 5, 1915 and May 28, 1914 will be found in the appended table.

The analysis of October 5, 1915 was made on account of the high numbers of bacteria found in the sample of September 7, 1915. During the interval between the taking of these two samples the reservoir had been cleaned and three woodchucks and several field mice, some of which were badly decayed, were found in the reservoir.

From these analyses it will be seen that the water is clear, colorless and very hard. The high nitrates as well as the high oxygen consumed and chlorine show that the water receives some pollution probably from the road, from the pasture above the road and from the houses north and south of the well.

The large numbers of bacteria in the sample of September 7, were probably largely caused by the decomposition of woodchucks and field mice in the reservoir. The number found in the samples obtained on October 5, while not high yet are greater than should be found in a good spring supply.

The presence of the B. coli in one c. c. sample indicates as did the chemical tests that the water receives some pollution.

As a result of the investigation and of the analyses the following conclusions may be drawn:

1. That the water supply obtained from the spring would be of a satisfactory sanitary quality if protected from pollution from the road, the pasture and the nearby houses.

2. That the proposed supply from the gravel pit should evidently be of a satisfactory quality provided the well is properly protected from surface drainage and from pollution by cattle or the cultivation of the land near the well.

In view of the above conclusions I would make the following recommendations:

1. That the well be protected from direct surface wash from the road or land across the road.
2. That the use of the land between the two houses be abandoned for use as a pasture.
3. That tight vaults be constructed to receive the wastes from the two houses above the spring or that the wastes be conveyed under the road in a tight sewer and disposed of in a suitable subservice disposal plant located some distance from and below the well.
4. That provision be made for suitably protecting the proposed supply from surface wash or other pollution.

Respectfully submitted,

THEODORE HORTON,
Chief Engineer

ALBANY, N. Y., *October 29, 1915*

REPORT OF WATER ANALYSIS FOR MARION

Source	Spring at pumping station	Tap, public supply	Tap, public supply
Collected on	4/23/14	9/7/15	10/5/15
Color	Trace	Trace	Trace
Odor, hot	1v	1v	1v
Odor, cold	1v	1v	1v
Turbidity	Clear	Clear	Clear
Solids, total	248	385	316
Loss on ignition	59	10	55
Mineral residue	189	375	261
Ammonia, free	.014	.002	.002
Ammonia, albuminoid	.024	.002	.016
Nitrites	.001	Trace	Trace
Nitrates	3.80	6.00	6.00
Oxygen consumed	0.80	2.40	1.20
Chlorine	3.00	4.75	4.75
Hardness, total	182.8	300.0	214.5
Alkalinity	157.0	188.0	188.0
Bacteria per c.c.	15	24,000	75
B. coli type, 10 c.c.	+	3+0—	3+0—
B. coli type, 1 c.c.	—	2+1—	2+1—
B. coli type, 1/10 c.c.	—	0+3—	0+3—

Results are expressed in parts per million. + Present. — Absent.
Abbreviations used to describe odors of water: 0, none; 1, very faint; 2, faint; 3, distinct; 4, decided; 5, strong; 6, very strong; a, aromatic; d, disagreeable; e, earthy; f, fishy; g, grassy; m, musty; v, vegetable.

MARLBORO

HERMANN M. BIGGS, M.D., *State Commissioner of Health:*

A reinspection of the public water supply of Marlboro was made on June 22, 1915, by Dr. C. W. Berry, sanitary supervisor of District "N." A previous investigation of this supply was made by the Engineering Division in 1908, a full report of which will be found on page 303 of the twenty-ninth annual report of this Department.

The public water supply of Marlboro is derived from a small stream which has its origin in two large springs. The supply is developed by a reservoir formed by a concrete dam across the stream at the mouth of a deep gully. This reservoir has been divided into two portions by means of a second dam at the upper end, this dam being constructed about two years ago. The

original capacity of the reservoir has also been somewhat enlarged by adding to the height of the old dam. In general the water supply system remains the same as described in the previous report although the supply is now owned and operated by the municipality which purchased it two years ago.

The reservoir is located about three miles west of the village. The watershed is only three-quarters of a square mile in area and is used for fruit farms except along the banks of the stream where it is used for pasture. There are four houses upon the watershed and with the exception of one, these houses are well removed from the stream. At the Norton Farm the barn is located directly on the stream and is so situated that all the surface wash from the barn yard and manure pile run directly into the stream. A hog pen is about 100 feet from the stream and a privy about 150 feet. In addition to these permanent sources of contamination there is danger of temporary contamination due to the presence during the summer of berry and fruit pickers, sometimes in large numbers, who use the water along the stream and in the reservoir for various purposes. There is no inspection or supervision of the watershed.

At the time of the previous report it was pointed out that the insanitary conditions at the Norton property not only favored the growth of algae in the reservoir, thereby causing unpleasant tastes and odors in the water, but also menaced the sanitary quality of the supply. It was therefore, recommended that measures be taken at once to have the insanitary conditions existing on the Norton farm abated. From the report of Dr. Berry it appears that this recommendation has not been carried out.

At the time of his inspection Dr. Berry collected samples of water from the reservoir and from a tap in the village and the results of the analyses of which together with others made in the past by the Division of Laboratories and Research will be found in the appended table.

These analyses show a moderately hard water somewhat high in color and occasionally turbid. At times there are marked odors due to the occurrence of algae. The figures for organic nitrogen in the form of free and albuminoid ammonia are moderately low. The chlorine content is somewhat above the normal for this vicinity. The total numbers of bacteria are usually high and organisms of the B. coli type are usually present in ten c. c. and occasionally in quantities as small as one c. c. indicating active contamination of human or animal origin.

In view of the above facts the following conclusions may be drawn:

1. The recommendation of the previous report has not been carried out.
2. That the water supply of Marlboro is menaced from a sanitary standpoint by the insanitary conditions existing at the Norton Farm and also by the presence at times of a large number of transient visitors to the watershed.
3. That the esthetic quality of the water supply is seriously depreciated by the occurrence of algae growths in the reservoir giving rise to objectionable tastes and odors.

I would therefore recommend:

1. That as previously recommended, the insanitary conditions at the Norton Farm be abated at once.
2. That, during times when a large number of transients are upon the watershed the village maintain an effectual sanitary patrol of the watershed to prevent accidental or wilful contamination of the supply.
3. That, in order to eliminate and control the algae growths in the reservoir the village consider the application of copper sulphate to the reservoir waters under the direction of a competent expert.
4. That, in case the village experience any difficulty in abating the insanitary conditions upon the watershed the village authorities apply to this Department for the enactment of Rules and Regulations for the sanitary protection of the supply.

Respectfully submitted,
THEODORE HORTON,
Chief Engineer

ALBANY, N. Y., *September* 15, 1915

RESULTS OF WATER ANALYSES

Abbreviations used to describe odors of water: 0, none; 1, very faint; 2, faint; 3, distinct; 4, decided; 5, strong; 6, very strong; a, aromatic, d, disagreeable; e, earthy; f, fishy; g, grassy; m, musty; v, vegetable

Municipality	County	Source of sample	Date of collection	PHYSICAL				CHEMICAL (PARTS PER MILLION)											BACTERIOLOGICAL			
						ODOR		SOLIDS			NITROGEN AS—						HARDNESS			B. COLI TYPE + = PRESENT — = ABSENT		
				Color	Turbidity	Cold	Hot	Total	Loss on ignition	Mineral residue	Free ammonia	Albuminoid ammonia	Nitrites	Nitrates	Oxygen consumed	Chlorine	Total	Alkalinity	Bacteria per c.c.; gelatin 20°, 48 hours	10 c.c.	1 c.c.	1-10 c.c.
Marlboro	Ulster	Tap, public supply	1/ 6/11	8	5	....	....	70	36	34	.050	.002	.004	0.88	2.60	3.00	31.2	29.0	600	+	+	—
Marlboro	Ulster	Tap, public supply	3/24/11	15	5	....	....	62	25	37	.016	.092	.001	0.30	2.90	2.50	29.9	24.0	190	+	—	—
Marlboro	Ulster	Tap, public supply	5/20/11	20	1	....	....	83	20	63	.018	.060	.001	0.10	2.20	2.87	36.4	35.0	50	+	—	—
Marlboro	Ulster	Tap, public supply	6/29/11	25	5	....	....	71	17	54	.130	.070	.002	0.04	1.74	2.75	41.6	31.0	200	+	+	—
Marlboro	Ulster	Tap, public supply	10/20/11	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	475	+	+	+
Marlboro	Ulster	Tap, public supply	12/12/11	7	Tr.	....	....	45	12	33	.020	.056	.001	0.30	0.72	3.50	32.5	20.0	170	+	—	—
Marlboro	Ulster	Tap, public supply	1/23/12	12	3	....	....	67	13	54	.024	.030	.001	0.48	0.60	2.52	36.4	28.0	100	—	—	—
Marlboro	Ulster	Tap, public supply	10/ 4/12	5	5	....	....	99	27	72	.010	.102	Tr.	0.08	0.50	2.75	48.6	48.0	210	+	+	—
Marlboro	Ulster	Tap, public supply	11/11/12	5	Cl.	....	....	85	17	68	.022	.094	.001	0.70	1.30	3.50	48.6	27.0	375	+	+	—
Marlboro	Ulster	Tap, public supply	1/31/13	5	Cl.	....	....	57	....	....	.018	.054	.001	0.34	0.90	3.00	32.5	22.0	130	+	—	—
Marlboro	Ulster	Tap, public supply	4/19/13	Tr.	Cl.	....	....	56	....	....	.020	.044	.001	0.16	1.50	1.76	31.2	22.0	325	—	—	—
Marlboro	Ulster	Tap, public supply	7/10/13	....	....	....	....	77	....	....	.014	.152	.001	0.04	2.90	2.50	48.6	42.0	220	+	—	—
Marlboro	Ulster	Tap, public supply	6/22/15	10	2	3 a.	3 a.	87	9	78	Tr.	.090	Tr.	0.02	2.80	2.00	44.3	44.0	*1,200	3+0—	1+2—	0+3—
Marlboro	Ulster	Reservoir	6/22/15	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	*550	3+0—	1+2—	0+3—

* Ice melted in water containers.

MASSENA

HERMANN M. BIGGS, M.D., *State Commissioner of Health:*

A reinspection of the public water supply of Massena was made on July 26, 1915 by Dr. B. R. Wakeman, sanitary supervisor of district "B." A previous investigation of this supply was made in 1911 by the Engineering Division the report of which will be found on page 741 of the thirty-second annual report of this Department.

The public water supply of Massena is pumped from the power canal which leads from the St. Lawrence river to the Grasse river at Massena. The supply is filtered through two pressure mechanical filters. The water works are owned by the St. Lawrence Water Company which purchases the water delivered from the Aluminum Company of America. The latter company owns the water supply pumps and filter and the water company owns the distributing lines, standpipe, hydrants, etc. The waterworks system in general remains practically the same as described in the earlier report. There has been installed, however, a new electrically operated centrifugal pump for delivering the water to the filters and distribution system. In addition the company has installed another centrifugal pump, furnishing 100 pounds pressure to be used in case of fire. The old pumps described in the earlier report have been abandoned and one of them has been removed.

On leaving the pump the water is treated with a solution of sulphate of aluminum before it reaches the filter. The old iron alum pots have been discarded as they were found to be unsatisfactory. The solution is now made in two wooden barrels from which two gallons of the solution are forced into the water main leading to the filter by hand pump every hour. The amount of alum applied in this way is approximately two pounds per hour which with a daily water consumption of 750,000 gallons per day gives about one-half grain of alum per gallon of water. The filters are practically the same as described in the earlier report, the rate of filtration being about 136,000,000 gallons per acre per day. The filters are washed two or three times a week the frequency depending somewhat upon the loss of head. The first filtrate after the filters have been washed is wasted for half an hour.

The power canal has a watershed directly tributary to it of about 6.4 square miles. This territory is very sparsely settled and there are apparently no sources of direct contamination. The water, however, which is largely derived from the St. Lawrence river is subject to the same sources of contamination as affect the sanitary quality of the river itself. Previous investigations of this Department upon the sanitary condition of the St. Lawrence river have shown that its contamination is such that it is not a safe supply without adequate purification.

At the time of the reinspection a large dredge was removing quantities of clay from the forebay about ninety feet west of the intake pipe. This clay is brought from the upper part of the canal in scows and dumped onto the bed of the canal at this point where it is lifted out by the dredge, loaded on to carts and drawn away. It is expected that the dredge operations will be continued for several summers.

At the time of the earlier inspection the following conclusions were drawn:

1. That the water from the St. Lawrence river from which the supply is derived is a satisfactory water supply with reference to those physical and esthetic qualities associated with freedom from turbidity, color and odor. It is however, known to receive sewage pollution from municipalities above, and although these impurities are subject to the purification resulting from dilution in a large volume of water, natural sedimentation, effect of sunlight, etc., fecal organisms are frequently present in such numbers as to indicate that this water could not be used at all times with safety from infection without the employment of some form of purification.

2. That in flowing through the canal from the St. Lawrence to the village, at which point the public supply is taken, some opportunity occurs for a slight further pollution from human and animal sources. Also, that, during a considerable period in the summer a great deterioration in the quality of the water occurs in the canal from its fouling with fine clay turbidity generated by dredging operations.

3. That the filters, as at present operated are inefficient in removing the bacteria and other impurities from the raw water.

4. That this inefficiency is due pricipally to

(a) Passing extremely turbid water having large amounts of fine clay in suspension directly through the filters.

(b) Failure to maintain reasonably low and uniform rates of filtration because of the lack or adequate filtering area.

(c) Insufficient quantity of coagulant at all times and failure to adjust the rate of application of coagulant to correspond with the amounts needed for various degrees of turbility of the raw water.

5. That the high turbidity of the water at times in the village mains is due to the failure of the filters to remove the extremely finely divided clay and at times to the by-passing of the filters.

It was, therefore, recommended:

1. That the St. Lawrence Water Company, take steps to improve the quality of water supplied by their works to the people of Massena by

(a) Subjecting the raw water to a period of sedimentation of several hours before passing it through the filters or else providing storage for filtered water such that it will be unnecessary to pump from the canal during turbid times.

(b) Increasing the filter area to reduce the rates of filtration, allow more flexibility of operation, and make it possible to put at least one unit out of operation in case of emergency.

(c) Installing approved appliances for feeding coagulant in proper quantities at all times.

2. That the St. Lawrence Water Company make and keep a record of the physical, chemical and bacteriological tests which are customarily made of the raw and filtered waters in an efficiently operated filter plant, in order that the best results be obtained at all times.

3. That frequent and thorough inspections be made by the Board of Health and the St. Lawrence Water Company of the sanitary conditions in the canal and upon the watershed tributary to the canal — with a view of discovering and preventing any accidental or wilful pollution of the public water supply.

From the report of Dr. Wakeman it will be seen that an attempt has been made to carry out recommendation No. 1-c, but that the other recommendations have not been acted upon. Furthermore, the present method of supplying the alum solution intermittently must be considered far from satisfactory.

At the time of his inspection Dr. Wakeman collected samples of water before and after filtration and the result of the analyses of these samples together with others made in the past by the Division of Laboratories and Research will be found in the appended table.

These analyses show clearly the unsatisfactory sanitary quality of the raw water and in many instances of the filtered water. The total bacterial counts in the filtered water are in most cases high and organisms of the B. coli type are frequently present in samples as small as 1 c.c., indicating low efficiency of the purification process.

In view of the above facts the following conclusions may be drawn:

1. That the recommendations of the previous report have not been carried out.

2. That in order to obtain a satisfactory supply of potable water for Massena it is essential that these earlier recommendations receive the attention of the local authorities.

In view of the failure of the water company to carry out the previous recommendations of this Department, it does not appear necessary at this time to make additional recommendations. These earlier recommendations, as given in detail above should, however, receive the immediate attention of the St. Lawrence Water Company.

Respectfully submitted,

THEODORE HORTON,

Chief Engineer

ALBANY, N. Y. *September* 30, 1915

RESULTS OF WATER ANALYSES

Abbreviations used to describe odors of water: 0, none; 1, very faint; 2, faint; 3, distinct; 4, decided; 5, strong; 6, very strong; a, aromatic; d, disagreeable; e, earthy; f, fishy; g, grassy; m, musty; v, vegetable

Municipality	County	Source of sample	Date of collection	Physical				Chemical (Parts per Million)											Bacteriological			
						Odor		Solids			Nitrogen as—						Hardness			B. Coli Type + = present — = absent		
				Color	Turbidity	Cold	Hot	Total	Loss on ignition	Mineral residue	Free ammonia	Albuminoid ammonia	Nitrites	Nitrates	Oxygen consumed	Chlorine	Total	Alkalinity	Bacteria per c.c.; gelatin 20°, 48 hours	10 c.c.	1 c.c.	1-10 c.c.
Massena	St. Lawrence...	Tap, public supply..........	1/ 8/12	5	Tr.	....	....	126	19	107	.020	.074	.001	0.10	1.40	6.75	102.8	96.0	150	+	+	—
Massena	St. Lawrence...	Tap, public supply..........	2/12/12	5	3	....	....	151	40	111	.020	.072	Tr.	0.14	1.20	7.50	100.0	97.0	50	+	—	—
Massena	St. Lawrence...	Tap, public supply..........	3/15/12	Tr.	Cl.	....	....	149	23	126	.018	.052	.001	0.14	1.90	7.00	108.6	96.0	103	+	—	—
Massena	St. Lawrence...	Tap, public supply..........	4/20/12	10	25	....	....	150	23	127	.006	.046	.001	0.08	1.80	7.00	91.4	90.0	1,700	+	+	—
Massena	St. Lawrence...	Tap, public supply..........	9/ 7/12	3	5	....	....	177	22	155	.002	.030	Tr.	0.08	1.40	7.00	91.4	90.0	3,000	+	+	—
Massena	St. Lawrence...	Tap, public supply..........	10/25/12	5	5	....	....	163	52	111	.010	.098	.001	0.08	1.90	7.87	100.0	96.0	700	+	+	—
Massena	St. Lawrence...	Tap, public supply..........	12/ 6/12	10	30	....	....	166	25	141	.014	.082	.001	1.10	2.40	7.00	114.2	94.0	13,500	+	+	—
Massena	St. Lawrence...	Tap, public supply..........	1/11/13	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	750	+	+	—
Massena	St. Lawrence...	Tap, public supply..........	2/14/13	5	Cl.	....	....	144	....	....	.008	.072	Tr.	0.10	1.80	7.00	102.8	94.0	90	+	—	—
Massena	St. Lawrence...	Tap, public supply..........	3/29/13	5	5	....	....	137	....	....	.018	.080	Tr.	0.10	1.60	6.50	102.8	90.0	2,800	+	—	—
Massena	St. Lawrence...	Tap, public supply..........	6/ 9/13	2	Tr.	....	....	143	....	....	.010	.060	.001	0.10	1.60	7.00	91.4	91.0	100	—	—	—
Massena	St. Lawrence...	Tap, public supply..........	6/20/13	7	10	....	....	162	....	....	.004	.038	.001	0.06	2.20	7.25	105.8	91.0	40	+	—	—
Massena	St. Lawrence...	Tap, public supply..........	7/25/13	Tr.	20	....	....	209	....	....	.004	.038	.001	0.08	0.90	5.00	97.2	94.0	300	+	+	—
Massena	St. Lawrence...	Tap, public supply..........	5/14/14	5	5	2 a.	2 a.	146	23	123	.004	.076	.001	0.10	2.30	7.75	94.2	89.0	100	+	+	+
Massena	St. Lawrence...	Forebay, raw water.........	7/26/15	Tr.	15	2 v.	2 v.	169	45	124	.006	.062	.001	0.08	2.70	10.0	102.8	93.0	500	3+0—	1+2—	0+3—
Massena	St. Lawrence...	Filtered water..............	7/26/15	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	350	3+0—	0+3—	0+3—
Massena	St. Lawrence...	Tap.........................	7/26/15	Tr.	15	2 v.	2 v.	188	45	143	.002	.040	.001	0.08	2.60	9.25	120.0	95.0	650	3+0—	1+2—	0+3—

MERRICK

HERMANN M. BIGGS, M.D., *State Commissioner of Health:*

An investigation of the public water supply of Merrick, L. I., was made by Mr. C. V. Baker, assistant engineer, on May 14, 1915.

Merrick is located in the county of Nassau, on the Montauk Branch of the Long Island railroad, about twenty-seven miles from New York City. The winter population is about 400, but this is increased to about 800 in the summer due to summer residents from the city.

The water supply is owned and controlled by the Hempstead and Oyster Bay Water Company. The source of the supply is wells, located near the center of the village which, however, is somewhat sparsely settled. The water is pumped from the wells both by means of a windmill and by gasoline engines. Storage is provided by means of an elevated tank for domestic use and an air pressure tank for fire protection. About 95 per cent. of the population are served with the water, there being a total of 125 service taps of which about two-thirds are metered. The consumption during the winter is from 10,000 to 15,000 gallons daily. The domestic pressure from the standpipe is about 25 pounds and the fire pressure from the air tank about 80 pounds.

Originally the pumping equipment consisted of a windmill which pumped the water from the wells into the standpipe, but the capacity of this plant becoming insufficient, gasoline engines and additional pumps were added and also air tanks by means of which adequate fire pressure is provided. The wells consist of one 12-inch tile well, two 4-inch and two 3-inch driven wells, the depth of the wells being about 45 feet. The stratum through which the wells pass is sand. There are two pumps operated by gasoline engines, one with a capacity of 100 gallons per minute and the other 250 gallons per minute. In addition to these there is a pump to which the windmill is attached and which pumps practically all the water required during the winter. The standpipe is constructed of wood and has a capacity of 15,000 gallons. The total water capacity of the steel air pressure tank is 12,000 or 13,000 gallons, the remainder of the tank being used for air pressure purposes. There are about six miles of water mains ranging in size from 2 to 6 inches, the majority of them, however, being 4 and 6-inch pipes.

The density of population within a radius of one quarter of a mile of the wells is approximately 550 per square mile and within one-half mile, 225 per square mile. Outside of this area and within the limits of the probable area of influence the population is about 100 per square mile. At the time of the inspection there appeared to be very little opportunity for pollution of the ground water in the immediate vicinity of the wells. The land on which the plant is located is leased by the company and only a small tract is provided for the plant and it is probable that the immediate vicinity will soon be built up, thus offering sources of contamination much nearer the wells.

A sample of water was collected from a tap at the pumping station when the pumps were in operation and sent to the Division of Laboratories and Research for analyses, the results of which are in the following table:

The results of the analyses indicate a water satisfactory in physical quality, but the figures of 1.50 for nitrates and 8.50 for chlorine are somewhat above the normal, thus indicating that pollution has found its way into the ground water from which the wells draw their supply. The figures of .006 and .004 for free and albuminoid ammonia respectively and also the presence of only 50 bacteria per c.c. with the B. coli type absent indicates, however, that the water has been well purified by its passage through the soil.

As stated above, there appeared to be little opportunity for pollution of the ground water in the immediate vicinity of the wells and in view of this fact it is probable that the purifying effect of the sand strata through which the ground water passes is sufficient under present conditions to render the pollution finding its way into the ground water inactive by the time it

REPORT OF WATER ANALYSIS FOR MERRICK

Source		Tap at pumping station
Collected on		May 14
Color		Trace
Turbidity		Clear
Odor, cold		1 v.
Odor, hot		1 v.
Solids, total		50
Loss on ignition		12
Mineral residue		38
Ammonia, free		.006
Ammonia, albuminoid		.004
Nitrites		Trace
Nitrates		1.50
Oxygen consumed		0.70
Chlorine		8.50
Hardness, total		22.10
Alkalinity		10.00
Iron		0.05
Bacteria per c.c.		50
B. coli type	10 c.c.	0+3—
	1 c.c.	0+3—
	1/10 c.c.	0+3—

Results are expressed in parts per million. + Present. — Absent.
Abbreviations used to describe odors of water: 0, none; 1, very faint; 2, faint; 3, distinct; 4, decided; 5, strong; 6, very strong; a, aromatic; d, disagreeable; e, earthy; f, fishy; g, grassy; m, musty; v, vegetable.

reaches the wells. With the increasing pollution in the vicinity, however, and the probability that houses will be erected much closer to the wells, it is probable that this purifying effect will not continue effective. Precaution, should therefore, be taken, providing buildings are erected in close proximity to the wells, to see that these buildings are provided with impervious cesspools or privies with watertight containers, the contents of which should be regularly removed and properly disposed of. Analyses of the water should be made occasionally during the year to detect any active contamination which may occur. Should these analyses at any time show active contamination steps should be immediately taken either to provide a new supply or to purify the present supply. Purification could doubtless be accomplished for a time at least by sterilizing the water with liquid chlorine.

As a result of this investigation it is apparent that the water supply at Merrick, although not actively contaminated at the time of the inspection, is receiving pollution to some extent, which, however, is well purified before reaching the supply. Nevertheless, it is possible that, should the population in the vicinity of the well appreciably increase, the supply may become actively contaminated. I, therefore, beg to submit the following recommendations, to be acted upon by the water company::

1. That any buildings erected in the vicinity of the well at any time be provided with adequate means of caring for the sewage so that such sewage will not pollute the ground water.
2. That analyses of the water be regularly made during the year to detect the presence of active contamination which may at any time occur.
3. That should active contamination at any time be found present, steps be immediately taken
   (a) To locate and eliminate the sources of pollution if possible, or if the contamination continues.
   (b) Sterilize the supply with liquid chlorine or purify it by some other satisfactory method.
   (c) Should these improvements fail to bring about the desired results, new wells or other supply, free from pollution, be developed.

Respectfully submitted,

THEODORE HORTON,
Chief Engineer

ALBANY, N. Y., *June* 8, 1915

MIDDLEPORT

HERMANN M. BIGGS, M.D., *State Commissioner of Health:*

An investigation of the public water supply of Middleport was made on October 9, 1915, by Mr. E. S. Chase, assistant engineer, of this Department, accompanied and aided by Dr. H. A. Wilmot, health officer, and Mr. Truman Jennings, president of the water board.

Middleport is an incorporated village with a present population of about 1,500, located in the eastern part of Niagara county on the Niagara Falls Branch of the N. Y. C. R. R., on the B. L. & R. Electric R. R., and on the Erie canal. The village is in the center of an extensive farming and fruit growing district and in addition to being a small trading center contains a few industries and a large canning factory. The village is provided with a municipal sewer system and sewage disposal plant.

The water supply is derived from a shallow well located about three miles southwest of the village. The waterworks system was designed by Mr. Charles Hopkins, civil engineer, and constructed by contract under his direction in 1912. The waterworks are owned and operated by the municipality under the direction of a Board of Water Commissioners. It is estimated that about 60 per cent. of the total population is served by the public supply, the remainder deriving water from numerous private wells scattered throughout the village. The exact daily water consumption is unknown although it may be estimated that about 100,000 gallons of water are used daily. During the fall a large amount of water is used by the canning factories. There are seven miles of cast iron water mains ranging in size from 4 to 19 inches in diameter and at present about 230 service taps all of which are metered. Water is pumped by electrically driven centrifugal pumps to a standpipe located on a small hill south of the village from which it is distributed by gravity to the village at an average pressure of about 74 pounds per square inch.

The well from which the supply is obtained is 60 feet in diameter and 15 feet deep. The well is encased by a concrete wall which extends about 6 inches above the surface of the surrounding ground. The excavation was made through about 2 feet of top soil and the remainder of the distance through limestone. The well is surrounded by a wire fence in order to keep out stray animals, etc. At times of drought there has been some difficulty in obtaining sufficient water from this well and four auxiliary wells have been driven within a radius of 500 feet of the large well. These wells are 6 inches in diameter with iron casing 28 feet deep. In 1914 water was pumped from these wells for a short period into the large shallow well by means of a portable pumping outfit.

The pumping station is a small stone building 20 by 30 feet in plan and the pumping outfit consists of two horizontal centrifugal pumps, directly connected to electric motors. The pump used regularly is a 4-inch 2-stage centrifugal pump operated by a 15-horse power Westinghouse induction motor. This pump is operated automatically according to the height of water in the standpipe. Its capacity is 220 gallons per minute when pumping against 160 feet total head. An emergency 6-inch 2-stage centrifugal pump is driven by a 40-horse power induction motor. This pump is controlled by hand and is used in case of emergency only. The suction line to the well is 8 inches in diameter and is provided with a foot valve and a check valve. From the pumping station the water is pumped through one and three quarter miles of 8-inch pipe to the standpipe. This standpipe is 14 feet in diameter and 65 feet high and has a capacity of about 75,000 gallons.

The well is located on a level plain and the nearest house is about one-quarter mile distant. The village owns two acres of land around the well and this area is adequately fenced so that cattle pastured in the vicinity have no access to the immediate neighborhood of the well. A highway is about 150 feet from the well and the elevation is about the same as that of the ground at the pumping station. As far as can be determined little, if any, opportunity for contamination exists in the immediate vicinity of the supply.

The bottom of the well is covered with a vegetable aquatic growth, which, however, has not given any trouble from tastes or odors. This may be due to the fact that the growth is removed at least once a year.

At the time of the inspection a sample of water was collected and the results of the analyses of this sample together with others made in the past by the Division of Laboratories and Research will be found in the appended table.

These analyses show a water slightly colored, clear and very hard. The figures for nitrogen in its various forms show moderate amounts of decomposable and decomposing organic matter. In the samples collected shortly after the well was first put into service the figures for nitrates are somewhat high, indicating the occurrence of considerable amounts of well-oxidized organic matter. However, in the last sample collected the figure for nitrates is low for a ground water supply. The high results for chlorine are probably due to the location of the well not far from the Salina formation. The total bacterial counts are high, but note should be made that two of the samples were two days in reaching the laboratory. In these particular samples organisms of the B. coli type were found in 10 c.c. inoculations. Taking into consideration the apparently satisfactory sanitary surroundings of the well and the fact that the samples were delayed in transit it seems probable that in this case the occurrence of the B. coli type has comparatively little sanitary significance.

In view of the above facts the following conclusions may be drawn:

1. That the public water supply of Middleport, although very hard, is of a reasonably satisfactory physical and sanitary quality.
2. That, as is true of all ground waters, the storage of the water in the large open well exposed to sunlight may foster the development of algae growths or other vegetable aquatic growths which bring about disagreeable tastes and odors.

I would therefore recommend:

1. That in case any difficulty is experienced with algae or other aquatic growths, the village authorities take steps to prevent such growths by providing the open well with a roof or cover.
2. That regular analyses of the supply be made occasionally throughout the year in order that evidence may be had as to its sanitary quality at various seasons and under different hydraulic conditions of the ground water.

Respectfully submitted,
THEODORE HORTON,
Chief Engineer

ALBANY, N. Y., *November* 13, 1915

REPORT OF WATER ANALYSES FOR MIDDLEPORT

Source	Tap, public supply	Tap, public supply	Tap, public supply	Tap, public supply
Collected on	4/10/13	5/28/13	7/16/13	10/9/15
Color	5	5	3	Trace
Odor, hot	3v	2v	2a	1v
Odor, cold	3v	2v	2a	1v
Turbidity	Trace	Trace	Clear	Clear
Solids, total	299	331	359	373
Loss on ignition	28	....	....	37
Mineral residue	271	....	....	336
Ammonia, free	.016	.020	.004	.002
Ammonia, albuminoid	.036	.020	.022	.024
Nitrites	.004	.010	.001	.001
Nitrates	1.60	0.90	0.70	0.30
Oxygen consumed	1.00	1.00	0.90	4.10
Chlorine	8.25	10.50	11.75	8.00
Hardness, total	214.5	228.5	264.5	321.5
Alkalinity	177.0	202.0	210.0	207.0
Bacteria per c.c.	40	*1,400	8,500	*275
B. coli type 10 c.c.	0+3—	1+2—	0+3—	2+1—
B. coli type 1 c.c.	0+3—	0+3—	0+3—	0+3—
B. coli type 1/10 c.c.	0+3—	0+3—	0+3—	0+3—

* Two days in transit.
Results are expressed in parts per million. + Present. — Absent.
Abbreviations used to describe odors of water: 0, none; 1, very faint; 2, faint; 3, distinct; 4, decided; 5, strong; 6, very strong; a, aromatic; d, disagreeable; e, earthy; f, fishy; g, grassy; m, musty; v, vegetable.

MINEOLA

HERMANN M. BIGGS, M.D., *State Commissioner of Health:*

An investigation of the public water supply at Mineola was made by Mr. C. M. Baker, assistant engineer, on May 15, 1915.

Mineola is situated in the county of Nassau on the main branch of the Long Island railroad about twenty-one miles from New York City. The population of the village is approximately 2,500 and is fairly constant, there being but little variation during the summer and winter. The sewage of the village is disposed of by means of cesspools and privies.

The water supply is owned by the village and consists of driven wells from which the water is pumped into a standpipe, whence it is distributed by gravity through the mains to the consumers. About 2,000, or 80 per cent., of the population, are served with water. There is a total of about 500 service taps of which one-half are metered. The water consumption for the year 1913 was 56,610,000 gallons, a daily average of 150,000 or the equivalent of 78 gallons per capita per day. The pressure on the mains varies from 60 to 70 pounds, depending upon the elevation of the water in the standpipe.

The water plant is located on the northeastern edge of the village near the Oyster Bay Branch of the Long Island railroad. The wells consist of one 12-inch driven well, 91 feet deep, and provided with cast-iron pipe casing, inside of which is a 10-inch suction, also one 18-inch tile well, 80 feet deep, which has an 8-inch suction. The strata through which the wells pass are sand and gravel. Two pumps, one Gould and one Smith-Vale, each with a capacity of 300 gallons per minute and driven by gasolene power, draw the water from the wells and force it into the standpipe. The pumps are located in a pit about 20 feet deep. The suction lift from the wells is about two feet. Located near the plant is the standpipe, the bottom of which is at an elevation of 125 feet above the ground and the top, 164 feet. Its capacity is 100,000 gallons. Eight miles of mains, varying in size from four to eight inches in diameter, convey the water through the village to the consumers.

The density of population within a radius of one-quarter of a mile of the wells is equivalent to approximately 575 persons per square mile and, within

a radius of one-half mile, 395 persons per square mile. Outside of this area and with the limits of the probable area of influence, the population is somewhat less, being approximately 150 per square mile. There are a number of sources of pollution in the immediate vicinity of the wells, the most dangerous of which is a cesspool which receives the sewage from the toilet in the pumping station and which is located only about 60 feet from the wells. To the west and east at a distance of about 150 or 200 feet are a number of buildings, the sewage of which is disposed of either by leaching cesspools or privies provided with earth vaults.

A sample of the water was taken from a tap at the pumping station and sent to the Division of Laboratories and Research for analysis, the results of which are as follows:

REPORT OF WATER ANALYSIS FOR MINEOLA

Source	Tap at pumping station
Collected on	May 17, 1915
Color	Trace
Turbidity	Clear
Odor, cold	1 v.
Odor, hot	1 v.
Solids, total	106
Loss on ignition	18
Mineral residue	88
Ammonia, free	.002
Ammonia, albuminoid	Trace
Nitrites	.001
Nitrates	1.80
Oxygen consumed	1.00
Chlorine	10.75
Hardness, total	61.40
Alkalinity	5.00
Iron	0.10
Bacteria per c.c	120
B. coli type	10 c.c. 3+0—
	1 c.c. 1+2—
	1 10 c.c. 0+3—

Results are expressed in parts per million. + Present. — Absent.

Abbreviations used to describe odors of water: 0, none; 1, very faint; 2, faint; 3, distinct; 4, decided; 5, strong; 6, very strong; a, aromatic; d, disagreeable; e, earthy; f, fishy; g, grassy; m, musty; v, vegetable.

It is apparent from the results of the analysis that the character of the water as regards appearance and taste is satisfactory. The figures for free and albuminoid ammonia and also for nitrites are comparatively low, thus indicating the presence of little unoxidized organic matter. The figures of 1.80 parts per million for nitrates and 10.75 for chlorine are high, the amount of chlorine being at least double the normal for this locality. The bacterial content of 120 per c.c. is somewhat high for a well water and the presence of B. coli in all the 10 c.c. samples and in one of the three 1 c.c. samples shows active contamination at the time the samples were taken. In general, the chemical analysis indicates that a considerable amount of organic contamination has in the past reached the ground water tributary to these wells, but that such contamination has become well oxidized by passing through the soil. On the other hand, the bacterial analyses show clearly the presence of a certain amount of active and potentially dangerous contamination of animal or human origin.

In order to improve as far as possible the present supply, it will be necessary to remove the sources of pollution, especially in the immediate vicinity of the wells. It therefore seems advisable that the village authorities provide or have provided water-tight containers for all privies and cesspools within a radius of not less than 500 feet of the wells. These containers should be regularly inspected by the village authorities and the contents, when they are emptied, should be satisfactorily disposed of in some remote place. It is possible that, with the removal of the immediate sources of pollution, the supply will be sufficiently improved to eliminate any immediate danger. However, with the dense population in the vicinity of the wells, there is always danger of the pollution, which in such cases always exists in the ground

water, becoming active at almost any time and, in view of this fact, analyses of the water should be regularly made at sufficiently frequent intervals to detect any active contamination. Should the analyses show active contamination at any time after improving the sanitary conditions in the vicinity of the wells as suggested above, steps should then be taken immediately to provide either a new supply of a satisfactory sanitary quality or adequate means of purifying the present supply. This purification might be accomplished by sterilizing the water with chlorine, should such treatment be found practicable. In view of the rather dense population near the wells, as pointed out above, there always exists the danger that the water supply may become activly contaminated at almost any time. This possibility would, however, be greatly reduced if a sewer system were provided for disposing of the sewage from the village. It would seem advisable, therefore, that the village authorities consider at the earliest possible date the installation of a complete sewerage system which should be extended so as to include the territory in the vicinity of the wells.

As a result of this investigation, it is apparent that the public water supply at Mineola was in an unsatisfactory condition at the time of the inspection, as is shown by the analysis of the sample then taken and the general conditions in the vicinity of the wells. The existence at any time of fecal organisms as indicated by the presence of B. coli is dangerous and steps should be taken at once to eliminate the sources of such active contamination.

I therefore beg to submit the following recommendations:

1. That the village authorities provide water-tight containers for all privies and cesspools within a distance of not less than 500 feet of the wells; and that they control the disposal of all sewage from all buildings within this territory.
2. That regular analyses of the water be made at frequent intervals to detect the existence of active contamination at any time.
3. That, should these analyses indicate the presence of active contamination after the above recommendations are carried out, steps be taken at once, either to provide a new supply or, if practicable, to sterilize the present supply by the use of liquid chlorine.
4. That the village authorities consider at the earliest possible date, the installation of a complete sewerage system.

Respectfully submitted,

THEODORE HORTON,
Chief Engineer

ALBANY, N. Y., *June* 10, 1915

MOUNT VERNON

HERMANN M. BIGGS, M.D., *State Commissioner of Health:*

A reinspection of the public water supply furnished by the New York Interurban Water Company to the city of Mount Vernon and to the villages of Mamaroneck and Pelham Manor, was made on September 3 and 4, 1915, by Mr. E. S. Chase, assistant engineer, and a previous inspection was made early in the year by Dr. L. W. Hubbard, sanitary supervisor of District "T." A still earlier inspection of this supply was made in 1909 by Professor H. N. Ogden in connection with a sanitary investigation of the city. This report of Professor Ogden will be found on page 805, vol. 2 of the thirtieth annual report of this Department.

The water supply of the New York Interurban Water Company is obtained from three sources, namely, the Hutchinson river, Tom Paine brook and the Mamaroneck river. The supply from the Hutchinson river consists mainly of the overflow from the New Rochelle reservoirs together with the drainage from the watershed between these reservoirs and the reservoir of the Interurban Company at Pelham. The water from Tom Paine brook is collected in a large reservoir, known as the Mahlsted reservoir, from which it is siphoned through a 16-inch line to the Pelham reservoir. The water from these two sources is then filtered through open slow sand filters. The supply from the

Mamaroneck river is collected in a small storage reservoir and then pumped through pressure mechanical filters after coagulation and sedimentation in a preliminary settling basin and after treatment with hypochlorite of lime. The description of these two filter plants will be found on pages 419 and 429, vol. 2 of the thirtieth annual report of this Department.

The watershed tributary to the Pelham reservoir below the New Rochelle reservoir is approximately 2.0 square miles in area and the population thereon may be roughly estimated at 150, or 75 per square mile. This area is crossed by several highways and is rapidly becoming developed as is all suburban property near New York city. There are probably no direct sources of contamination of this stream although the density of population renders accidental and intermittent contamination a serious menace to the supply.

The Mahlsted reservoir has a watershed of about 1.9 square miles which is less densely inhabited than the Pelham source and the population may be estimated at 150, or 75 per square mile. The reservoir has a capacity of 80,000,000 gallons and the water from it is used only at such times as it is necessary to supplement the supply from the other sources.

The Mamaroneck watershed has an area of approximately 12.8 square miles and a resident population roughly estimated at 1,500 to 2,000, or 125 to 150 per square mile. The upper part of this watershed is located in the village of White Plains and a portion of the sewer system of that village passes through the watershed, in some cases the sewer lines are close to the river or its tributaries. These sewer lines discharge at a small pumping station which pumps the sewage into the Bronx Valley sewer system. At times of heavy rainfall the pumping equipment is insufficient to pump the entire flow and at such times there often occurs overflow through manholes and thence into the stream. There are several large public institutions upon the watershed and one large summer hotel. With the exception of the hotel the sewage from these places discharges off the watershed. At the hotel there is a sewage disposal plant for the treatment of the sewage. Considerable trouble is experienced with the proper operation of this plant and at times serious contamination has occurred. At the time of the recent inspection it was found that a small pumping station for pumping sewage from two or three houses into the disposal plant of the hotel was out of service and the pump well was being cleaned of sewage sludge. This sludge was pumped into a surface ditch leading directly to the stream and there was evidence that serious contamination of the stream had occurred.

Rules and regulations for the sanitary protection of the water supply of Mt. Vernon were enacted by this Department in 1907. The water company maintains regular inspections of the various watersheds and numerous violations of the rules have been abated from time to time.

In White Plains on a plot of land laid out for real estate development a garbage dump has been maintained which, however, was not in use at the time of the inspection and had been covered with sand and gravel. This dump is very near the stream on the edge of a marsh draining into the brook. The location of this dump is a violation of the water rules.

On the property of the Bloomingdale hospital a drain tile enters the brook. It is claimed that at times sewage is discharged from this drain but this was not verified at the time of the inspection. Efforts should however be made by the water company to determine the source of drainage from this tile.

The Mamaroneck filters treat from 2,000,000 to 2,250,000 gallons of water per day and at the rate of 125,000,000 gallons per acre per day. The filters at the Pelham plant, which approximate 1 acre in total area treat about 750,000 gallons per day. The water company is planning to replace the present hypochlorite plant by apparatus for sterilization of the Mamaroneck supply with liquid chlorine and expects to have such apparatus installed within the next month or so. The water of the Pelham supply is treated with hypochlorite as it goes on to the filter through a rather crude arrangement of barrels. It seems very probable that this arrangement brings about little if any beneficial results.

Simple physical, chemical and bacteriological tests are made daily of the raw and filtered Mamaroneck water by the engineer in charge of the plant. Frequent analyses are also made of the raw and filtered waters at both the Mamaroneck and Pelham plants by the Lederle laboratories.

At the time of the inspection samples of both raw and filtered water from both sources of supply were collected and the results of the analyses of these samples together with others made in the past by the Division of Laboratories and Research will be found in the appended table.

These analyses show clearly the unsatisfactory sanitary quality of both sources of raw water and their unfitness for a public supply without sufficient purification. The analyses of the filtered water, however, show fairly low bacterial counts and the presence of B. Coli in comparatively small amounts indicating a fairly satisfactory degree of efficiency for the purification process. At times, however, the bacterial efficiencies are not as high as should be obtained, although with improvements in the methods of sterilization it seems probable that more uniformly satisfactory results will be obtained in the future.

In view of the above facts the following conclusions may be drawn:

1. That the sources of contamination, both direct and indirect upon the watersheds tributary to the public water supply of Mt. Vernon render it necessary to subject the water to very careful and efficient purification.

2. The most serious opportunities for direct contamination exist from the sewage disposal plant of the Gedney Farm Hotel and neighboring cottages and from the sewers of the village of White Plains at times of overflow.

3. That other possible sources of contamination are the garbage dump in the village of White Plains and the drain crossing the Bloomingdale hospital grounds.

4. That the filters at both Mamaroneck and North Pelham are apparently giving a reasonably satisfactory purification.

5. That the method of application of the hypochlorite solution at the North Pelham plant is very crude and the point of application, before filtration, is not in accordance with the best practice.

6. That the proposed substitution of liquid chlorine for sterilization of the Mamaroneck supply is a step in the right direction.

I would therefore recommend:

1. That the attention of the village of White Plains be called to the inadequate pumping equipment at the Westchester avenue sewage pumping station and furthermore that the village be urged to properly maintain all sewers leading to this station in order that no overflows from them into the Mamaroneck river may occur.

2. That the attention of the management of the Gedney Farm Hotel be called to the necessity of operating the sewage disposal plant of the hotel and adjacent cottages with constant care and supervision in order to prevent any contamination of the brook tributary to the Mamaroneck river, pending the extension of the sewer system of White Plains and the connection of the hotel sewers with this municipal system.

3. That the water company notify the village of White Plains that the garbage dump near this stream is a violation of the water rules enacted by this Department.

4. That the water company take steps to determine if sewage reaches the brook tributary to the Mamaroneck river from the drain crossing the Bloomingdale property and if such is found to be the case, to prevent such discharge.

5. That the water company continue their supervision of the various watersheds tributary to their supply and continue their efforts to reduce the sources of contamination to a minimum.

6. That the water company provide a more satisfactory method of sterilizing the supply at the North Pelham plant. In this connection it would be well to apply the sterilizing agent to the filtered water in the clear water well and also to consider the substitution of liquid chlorine for hypochlorite.

Respectfully submitted,

THEODORE HORTON,

Chief Engineer

ALBANY, N. Y., *October* 5, 1915

RESULTS OF WATER ANALYSES

Abbreviations used to describe odors of water: 0, none; 1, very faint; 2, faint; 3, distinct; 4, decided; 5, strong; 6, very strong; a, aromatic, d, disagreeable; e, earthy; f, fishy; g, grassy; m, musty; v, vegetable

Municipality	County	Source of sample	Date of collection	Physical: Color	Physical: Turbidity	Physical: Odor: Cold	Physical: Odor: Hot	Chemical (Parts per Million): Solids: Total	Solids: Loss on ignition	Solids: Mineral residue	Nitrogen as— Free ammonia	Nitrogen as— Albuminoid ammonia	Nitrogen as— Nitrites	Nitrogen as— Nitrates	Oxygen consumed	Chlorine	Hardness: Total	Hardness: Alkalinity	Bacteriological: Bacteria per c.c.; gelatin 20°, 48 hours	B. Coli Type (+ = present, — = absent): 10 c.c.	B. Coli Type: 1 c.c.	B. Coli Type: 1-10 c.c.
Mt. Vernon....	Westchester....	Tap, filtered water..........	1/14/14	....	....	....	....	....	....	....	....	....	....	....	....	......	......	......	190	1+2—	0+3—	0+3—
Mt. Vernon....	Westchester....	Tap, filtered water..........	1/14/14	....	....	....	....	....	....	....	....	....	....	....	....	......	......	......	90	0+3—	0+3—	0+3—
Mt. Vernon....	Westchester....	Tap, filtered water..........	1/14/14	5	Tr.	1 v.	1 v.	162	37	125	.010	.034	.003	1.40	2.70	9.75	94.3	47.0	......	......	......	......
Mt. Vernon....	Westchester....	Tap, filtered water..........	2/25/14	....	....	....	....	....	....	....	....	....	....	....	....	......	......	......	30	0+3—	0+3—	0+3—
Mt. Vernon....	Westchester....	Tap, filtered water..........	2/25/14	....	....	....	....	....	....	....	....	....	....	....	....	......	......	......	35	0+3—	0+3—	0+3—
Mt. Vernon....	Westchester....	Tap, filtered water..........	2/25/14	7	3	1 v.	1 v.	108	25	83	.056	.062	.001	0.70	2.20	7.00	52.9	24.0	......	......	......	......
Mamaroneck...	Westchester....	Reservoir, raw water........	3/18/14	20	15	2 v.	2 v.	68	16	52	.052	.148	.002	0.24	5.60	2.67	26.0	15.0	5,700	3+0—	3+0—	0+3—
Mamaroneck...	Westchester....	Mixed effluents of filters.....	3/18/14	Tr.	2	....	....	55	13	42	.046	.052	.002	0.24	2.00	4.50	27.3	9.0	15	0+3—	0+3—	0+3—
Pelham........	Westchester....	Raw water at filter..........	3/18/14	....	....	....	....	....	....	....	....	....	....	....	....	......	......	......	140	3+0—	0+3—	0+3—
Pelham........	Westchester....	Mixed effluent of filters......	3/18/14	12	Cl.	1 a.	1 a.	92	13	79	.180	.080	.001	2.00	2.50	7.75	67.1	43.0	15	0+3—	0+3—	0+3—
Pelham........	Westchester....	Tap, filtered water..........	4/18/14	7	Tr.	1 a.	1 a.	106	38	68	.024	.062	.001	0.46	2.00	5.50	42.9	18.0	*1,400	1+2—	0+3—	0+3—
Pelham........	Westchester....	Tap, filtered water..........	4/18/14	....	....	....	....	....	....	....	....	....	....	....	....	......	......	......	*2,800	0+3—	0+3—	0+3—
Pelham........	Westchester....	Tap, filtered water..........	6/22/14	5	Cl.	1 v.	1 v.	120	33	87	.004	.042	Tr.	0.16	0.80	7.75	52.9	41.0	*2,800	0+3—	0+3—	0+3—
Pelham........	Westchester....	Tap, filtered water..........	6/22/14	....	....	....	....	....	....	....	....	....	....	....	....	......	......	......	*5,500	0+3—	0+3—	0+3—
Pelham........	Westchester....	Tap, filtered water..........	7/13/14	....	....	....	....	....	....	....	....	....	....	....	....	......	......	......	*2,100	2+1—	0+3—	0+3—
Pelham........	Westchester....	Tap, filtered water..........	7/13/14	....	....	....	....	....	....	....	....	....	....	....	....	......	......	......	400	0+3—	0+3—	0+3—
Pelham........	Westchester....	Tap, filtered water..........	7/13/14	....	....	....	....	....	....	....	....	....	....	....	....	......	......	......	250	2+1—	0+3—	0+3—
Pelham........	Westchester....	Tap, filtered water..........	8/ 4/14	....	....	....	....	....	....	....	....	....	....	....	....	......	......	......	380	3+0—	2+1—	1+2—
Pelham........	Westchester....	Tap, filtered water..........	8/ 6/14	....	....	....	....	....	....	....	....	....	....	....	....	......	......	......	40	1+2—	0+3—	0+3—
Pelham........	Westchester....	Tap, filtered water..........	8/26/14	12	2	1 v.	1 v.	127	47	80	.006	.020	Tr.	0.06	4.60	6.38	51.4	50.0	200	2+1—	0+3—	0+3—
Pelham........	Westchester....	Tap, filtered water..........	8/26/14	....	....	....	....	....	....	....	....	....	....	....	....	......	......	......	200	1+2—	0+3—	0+3—
lham........	Westchester....	Tap, filtered water..........	10/ 7/14	....	....	....	....	....	....	....	....	....	....	....	....	......	......	......	600	1+2—	0+3—	0+3—
lham........	Westchester....	Tap, filtered water..........	10/ 7/14	....	....	....	....	....	....	....	....	....	....	....	....	......	......	......	650	1+2—	0+3—	0+3—

RESULTS OF WATER ANALYSES

Abbreviations used to describe odors of water: 0, none; 1, very faint; 2, faint; 3, distinct; 4, decided; 5, strong; 6, very strong; a, aromatic; d, disagreeable; e, earthy; f, fishy; g, grassy; m, musty; v, vegetable.

Municipality	County	Source of sample	Date of collection	PHYSICAL				CHEMICAL (PARTS PER MILLION)											BACTERIOLOGICAL			
						ODOR		SOLIDS			NITROGEN AS—						HARDNESS			B. COLI TYPE + = PRESENT — = ABSENT		
				Color	Turbidity	Cold	Hot	Total	Loss on ignition	Mineral residue	Free ammonia	Albuminoid ammonia	Nitrites	Nitrates	Oxygen consumed	Chlorine	Total	Alkalinity	Bacteria per c.c.; gelatin 20°, 48 hours	10 c.c.	1 c.c.	1-10c.c.
Pelham	Westchester	Tap, filtered water	10/ 7/14	10	2	1 v.	1 v.	77	16	61	.008	.080	.001	0.16	3.50	3.00	52.9	37.0	475	1+2—	0+3—	0+3—
Pelham	Westchester	Tap, filtered water	12/10/14	Tr.	2	1 v.	1 v.	127	30	97	.030	.076	.001	1.00	2.20	12.00	60.0	24.0	500	1+2—	0+3—	0+3—
Pelham	Westchester	Tap, filtered water	12/10/14	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	150	3+0—	0+3—	0+3—
Pelham	Westchester	Tap, filtered water	12/10/14	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	130	0+3—	0+3—	0+3—
Mt. Vernon	Westchester	Tap, filtered water	2/17/15	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	120	0+3—	0+3—	0+3—
Mt. Vernon	Westchester	Tap, filtered water	2/17/15	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	50	1+2—	0+3—	0+3—
Mt. Vernon	Westchester	Tap, filtered water	2/17/15	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	40	0+3—	0+3—	0+3—
Mt. Vernon	Westchester	Tap, filtered water	2/17/15	25	5	2 v.	2 v.	85	11	74	.012	.026	.001	0.60	3.80	7.13	48.6	21.0	....	....	....	....
Mt. Vernon	Westchester	Tap, filtered water	5/ 6/15	5	Tr.	2 v.	2 v.	108	12	96	.002	.028	Tr.	0.16	2.80	6.88	50.0	48.0	30	0+3—	0+3—	0+3—
Mt. Vernon	Westchester	Tap, filtered water	5/ 6/15	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	70	1+2—	0+3—	0+3—
Mt. Vernon	Westchester	Raw water, Mamaroneck	9/ 4/15	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	†3,900	3+0—	3+0—	1+2—
Mt. Vernon	Westchester	Filtered water, Mamaroneck	9/ 4/15	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	†250	1+2—	0+3—	0+3—
Mt. Vernon	Westchester	Raw water, Pelham	9/ 4/15	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	†5,400	1+2—	0+3—	0+3—
Mt. Vernon	Westchester	Filtered water, Pelham	9/ 4/15	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	†40	1+2—	1+2—	0+3—

* Delayed in transit. † Two days in transit and ice in containers melted.

NORTH TARRYTOWN

HERMANN M. BIGGS, M.D., *State Commissioner of Health*:

An inspection of the public water supply furnished by the Consolidated Water Company of Suburban New York to the villages of North Tarrytown, Hastings-on-Hudson, Dobbs Ferry, Ardsley and the town of Scarsdale was made by Dr. L. W. Hubbard, sanitary supervisor of District "T," on January 26, 1915. A previous investigation of this supply was made by the engineering division in 1910, a full report of which will be found on page 569 of the thirty-first annual report of this Department.

The water supply furnished by the Consolidated Water Company is derived from the Pocantico river about three miles north of the village of Tarrytown. At this point there is a large storage reservoir known as Pocantico lake, near which is located the filter house containing four units of pressure mechanical filters. After filtration the water is pumped into the mains leading to the several communities supplied. In addition to filtration, hypochlorite of lime is added to the raw water just previous to filtration. The reservoir, filter plant, pumping equipment and waterworks system in general remain the same as described in detail in the earlier report. The number of services have increased to 2,200 and the population supplied may be estimated at upwards of 12,000. The present water consumption is approximately 1,800,000 gallons. All the services are now metered.

The watershed tributary to the Pocantico reservoir is approximately 12.5 square miles in area. A large portion of this area consists of steep, rocky and wooded hills of little value for agricultural purposes. A certain amount of the area, however, is used for farming and grazing. Along the borders of the stream in low parts of the valley there is considerable swampy ground. There are approximately 100 houses located upon the watershed and the resident population may be estimated at 500, or about 40 per square mile. Most of these dwellings are comparatively well back from the stream.

The village of Briar Cliff Manor, with a sewerage system and sewage disposal plant, is located about two miles above the reservoir. It is said that at times the pumping equipment is insufficient to discharge the total sewage flow into or upon the irrigation area and that at such times a certain amount of sewage overflows and reaches the stream. Plans for a new and improved sewage disposal plant have been approved by this Department and it is expected that these improvements will be made in the near future, thus doing away with the present danger of overflow. Another sewage disposal plant upon this watershed is located at St. Joseph's Normal School. At the time of the inspection there appeared to be no contamination reaching the stream from this plant.

In addition to the specific points of possible pollution there is also opportunity for contamination due to surface wash from cultivated lands, from the vicinity of dwellings, from highways, from the railroad embankment which passes through the area and from other sources always present upon a populated watershed.

At the time of the previous inspection it was found that the filters were not giving particularly good efficiency due probably to the high rates at which they were at times operated. It was therefore recommended:

1. That the water company be urged to consider the feasibility of increasing the filter area with a view to lowering the rates of filtration, thus improving the efficiency of the filters.
2. That the water company take steps to prevent the pollution of the streams entering the Pocantico reservoir.
3. That the trustees of the Christian Brothers Normal School at Pocantico Hills be notified to take immediate steps to correct the defect in the sewage disposal plant and prevent any unpurified sewage reaching the nearby brook.
4. That if the water company should experience any difficulty in abating the insanitary conditions affecting the water supply, they should apply to this Department for the enactment of rules and regulations for the protection of the watershed.

From the report of Dr. Hubbard it appears that the filter capacity has not been increased although steps have been taken in certain instances to remove some of the sources of pollution. It also appears that the sewage disposal plant at St. Joseph's Normal School was operating properly at the time of the inspection. Rules and regulations for the protection of this supply were enacted by this Department on February 17, 1915.

The filtration plant and the watershed are under the supervision of the Lederle laboratories, by whom analyses are made at least every month and inspections of the watershed four times a year.

Results of the analyses of this supply made in the past by the Division of Laboratories and Research will be found in the appended table.

The earlier analyses indicate that the filter plant has not always attained a satisfactory degree of efficiency. At times the total number of bacteria in the filtered water have been high and the organisms of the B. coli type occasionally present in samples as small as 1/10 c.c. The results of the analyses of samples collected since 1912 show an apparent improvement in the efficiency of the purification process, the total number of bacteria in the treated water being less than in earlier years and organisms of the B. coli type absent in the majority of 10 c.c. samples. The analyses of the raw water show its contaminated condition as indicated by the high bacterial content and frequent occurrence of B coli in 1/10 c.c. samples. The raw water is usually comparatively high in color and turbidity, while the filtered water is only slightly colored and comparatively clear.

In view of the above facts the following conclusions may be drawn:

1. That the recommendations of this Department have in part been carried out by the Consolidated Water Company of Suburban New York.
2. That the raw water supply as obtained from Pocantico lake is open to serious contamination from the surface wash of the comparatively well populated area, from the effluents of sewage disposal plants, from the overflow from the Briarcliff Manor sewerage system at times of storms and possibly from the toilets of the passenger coaches of the railroad trains.
3. That, while the storage afforded by Pocantico lake gives a certain amount of protection, the dangerous quality of the supply renders it necessary to operate the purification process with constant care and efficiency.
4. That the method of applying hypochlorite of lime to the raw water before filtration is not in accordance with the best practice and if possible sterilization should be carried out subsequent to filtration.

I would therefore recommend:

1. That the water company consider increasing the filter capacity as previously recommended.
2. That the water company continue to operate the filters with as high a degree of efficiency as possible.
3. That the water company sterilize the filtered water instead of the raw water and in case this change is made it would be well for the company to consider the abandonment of the use of hypochlorite of lime and substitute liquid chlorine.
4. That the water company maintain and enforce at all times the rules and regulations enacted by this Department for the sanitary protection of the watershed tributary to their supply.

Respectfully submitted,

THEODORE HORTON,

Chief Engineer

ALBANY, N. Y., *July* 15, 1915

RESULTS OF WATER ANALYSES

Abbreviations used to describe odors of water: 0, none; 1, very faint; 2, faint; 3, distinct; 4, decided; 5, strong; 6, very strong; a, aromatic; d, disagreeable; e, earthy; f, fishy; g, grassy; m, musty; v, vegetable

Municipality	County	Source of sample	Date of collection	Physical				Chemical (Parts Per Million)											Bacteriological			
						Odor		Solids			Nitrogen as—						Hardness			B. Coli Type + = present — = absent		
				Color	Turbidity	Cold	Hot	Total	Loss on ignition	Mineral residue	Free ammonia	Albuminoid ammonia	Nitrites	Nitrates	Oxygen consumed	Chlorine	Total	Alkalinity	Bacteria per c.c.; gelatin 20°, 48 hours	10 c.c.	1 c.c.	1-10 c.c.
N. Tarrytown..	Westchester....	Raw water........	1/ 5/11	....	....	....	....	....	....	....	....	....	....	....	....	6.75	......	16.0	2,800	+	+	+
N. Tarrytown..	Westchester....	Filtered water........	1/ 5/11	10	10	....	....	179	60	119	.122	.100	.003	1.10	3.00	7.00	39.0	25.0	1,200	+	+	+
N. Tarrytown..	Westchester....	Raw water........	3/21/11	....	....	....	....	....	....	....	....	....	....	....	....	......	......	......	2,500	+	+	—
N. Tarrytown..	Westchester....	Filtered water........	3/21/11	5	Cl.	....	....	92	42	50	.062	.076	.003	1.00	1.70	5.00	40.3	13.0	400	—	—	—
N. Tarrytown..	Westchester....	Raw water........	5/10/11	10	10	....	....	100	27	73	.008	.128	.001	0.40	1.40	5.62	37.7	8.0	500	+	—	—
N. Tarrytown..	Westchester....	Filtered water........	5/10/11	5	Cl.	....	....	96	21	77	.032	.064	.003	0.20	0.50	5.62	36.4	9.0	40	—	—	—
N. Tarrytown..	Westchester....	Raw water........	6/28/11	25	7	....	....	113	28	85	.116	.222	.005	0.30	6.50	5.25	68.6	40.0	1,300	+	+	—
N. Tarrytown..	Westchester....	Filtered water........	6/28/11	25	5	....	....	118	29	89	.122	.176	.003	0.30	6.00	5.75	68.6	32.0	2,100	+	+	—
N. Tarrytown..	Westchester....	Raw water........	10/18/11	20	Tr.	....	....	130	24	106	.048	.164	.003	0.30	3.40	6.37	50.0	37.0	900	+	+	—
N. Tarrytown..	Westchester....	Filtered water........	10/18/11	15	Tr.	....	....	123	31	102	.028	.158	.001	0.30	3.10	6.12	50.0	33.0	2,800	+	—	—
N. Tarrytown..	Westchester....	Raw water........	12/ 6/11	....	....	....	....	....	....	....	....	....	....	....	....	......	......	......	500	+	+	+
N. Tarrytown..	Westchester....	Filtered water........	12/ 6/11	5	5	....	....	103	25	78	.006	.042	.002	0.50	2.15	5.62	35.1	8.0	90	+	+	—
N. Tarrytown..	Westchester....	Raw water........	1/17/12	15	5	....	....	92	23	69	.034	.062	.002	0.50	2.00	5.25	40.3	26.0	375	+	+	—
N. Tarrytown..	Westchester....	Filtered water........	1/17/12	Tr.	Cl.	....	....	89	21	68	.044	.030	.001	0.52	0.90	5.75	42.9	19.0	20	—	—	—
N. Tarrytown..	Westchester....	Raw water........	3/27/12	15	5	....	....	68	22	46	.050	.114	.001	0.48	2.10	3.75	29.9	13.0	1,800	+	+	—
N. Tarrytown..	Westchester....	Filtered water........	3/27/12	Tr.	Cl.	....	....	81	19	62	.062	.062	Tr.	0.50	0.90	4.25	29.9	10.0	100	—	—	—
N. Tarrytown..	Westchester....	Raw water........	5/ 3/12	....	....	....	....	....	....	....	....	....	....	....	....	......	......	......	8,800	+	+	+
N. Tarrytown..	Westchester....	Filtered water........	5/ 3/12	10	Tr.	....	....	91	21	70	.024	.106	.001	0.32	2.60	3.50	32.5	20.0	250	+	+	—
N. Tarrytown..	Westchester....	Raw water........	8/ 5/12	20	15	....	....	115	28	87	.110	.170	.001	0.02	5.70	6.75	57.1	53.0	425	+	+	—
N. Tarrytown..	Westchester....	Filtered water........	8/ 5/12	7	Cl.	....	....	106	21	85	.092	.078	.001	0.06	2.50	6.75	58.6	47.0	230	+	—	—
N. Tarrytown..	Westchester....	Raw water........	10/16/12	10	2	....	....	117	16	101	.120	.120	.005	0.08	2.30	7.50	82.0	48.0	700	—	—	—
N. Tarrytown..	Westchester....	Filtered water........	10/16/12	....	....	....	....	....	....	....	....	....	....	....	....	......	......	......	190	—	—	—
N. Tarrytown..	Westchester....	Raw water........	1/22/13	20	5	....	....	....	....	....	.024	.094	.001	0.14	3.30	4.50	37.7	17.0	1,400	+	+	—

RESULTS OF WATER ANALYSES—(*Continued*)

Abbreviations used to describe odors of water: 0, none; 1, very faint; 2, faint; 3, distinct; 4, decided; 5, strong; 6, very strong; a, aromatic; d, disagreeable; e, earthy; f, fishy; g, grassy; m, musty; v, vegetable

Municipality	County	Source of sample	Date of collection	PHYSICAL				CHEMICAL (PARTS PER MILLION)											BACTERIOLOGICAL			
						ODOR		SOLIDS			NITROGEN AS—						HARDNESS			B. COLI TYPE + = PRESENT — = ABSENT		
				Color	Turbidity	Cold	Hot	Total	Loss on ignition	Mineral residue	Free ammonia	Albuminoid ammonia	Nitrites	Nitrates	Oxygen consumed	Chlorine	Total	Alkalinity	Bacteria per c.c.; gelatin 20°, 48 hours	10 c.c.	1 c.c.	1-10 c.c.
N. Tarrytown..	Westchester....	Filtered water..............	1/22/13	15	Cl.	....	....	81	....	....	.030	.066	Tr.	0.70	1.20	4.75	39.0	10.0	40	—	—	—
N. Tarrytown..	Westchester....	Raw water..............	2/26/13	15	10	....	....	90	....	....	.076	.106	.002	0.70	1.80	5.25	44.3	23.0	3,200	+	+	—
N. Tarrytown..	Westchester....	Filtered water..............	2/26/13	25	2	....	....	90	....	....	.052	.086	.001	0.50	1.00	5.25	45.7	16.0	600	—	—	—
N. Tarrytown..	Westchester....	Raw water..............	4/ 9/13	20	2	....	....	88	....	....	.042	.116	.001	0.50	2.60	4.00	42.9	19.0	600	+	—	—
N. Tarrytown..	Westchester....	Filtered water..............	4/ 9/13	5	Cl.	....	....	82	....	....	.030	.054	Tr.	0.32	1.30	4.25	42.9	13.0	15	—	—	—
N. Tarrytown..	Westchester....	Raw water..............	5/21/13	22	3	....	....	92	....	....	.026	.100	.003	0.20	3.30	4.75	60.0	33.0	1,400	+	+	—
N. Tarrytown..	Westchester....	Purified water..............	5/21/13	12	Cl.	....	....	83	....	....	.018	.068	Tr.	0.26	2.00	4.75	44.3	26.0	140	—	—	—
N. Tarrytown..	Westchester....	Raw water..............	11/10/13	40	5	....	....	112	....	....	.048	.160	.001	0.20	7.70	5.38	45.7	29.0	2,500	+	+	—
N. Tarrytown..	Westchester....	Purified water..............	11/10/13	35	2	....	....	114	....	....	.038	.120	.001	0.20	6.20	5.63	52.9	22.0	150	+	+	—
N. Tarrytown..	Westchester....	Raw water..............	3/17/14	20	12	2 m.	1 m.	78	17	61	.106	.114	.002	0.40	4.50	3.75	32.5	20.0	41,500	.....	.....	.....
N. Tarrytown..	Westchester....	Purified water..............	3/17/14	Tr.	Cl.	1 v.	1 v.	75	16	59	.106	.048	.003	0.40	2.00	4.12	35.1	15.0	10	—	—	—

NORTH TONAWANDA

HERMANN M. BIGGS, M.D., *State Commissioner of Health:*

An investigation of the operation of the water supply chlorination plant at North Tonawanda was made by Mr. C. M. Baker, assistant engineer, on July 2, 1915.

As the result of an excessive amount of typhoid in the city during 1914, a chlorinating apparatus, of the Wallace & Tiernan type, was installed by the Department at North Tonawanda on November 11, 1914. This apparatus was operated by one of the assistant engineers of this Department until December 3, 1914. Samples of the water were collected from various places in the city before and after the plant was put into operation.

The results of the analyses of these samples indicated so conclusively the effectiveness of the treatment that the city decided to install a chlorination plant of its own, but requested that the Department leave its apparatus there until the city plant was installed. This request was granted, the operation of the plant being turned over to the city authorities on December 3, 1914. On March 5, 1915, the apparatus belonging to the Department was removed and it was then learned that the plant had not been in operation for about three weeks prior to that time. The new apparatus, however, had been received by the city and was installed and put into operation the following day, March 6, 1915. Since then it has been continuously in operation except for about two days when the apparatus became clogged and it was necessary for the city to have a representative of the company make repairs.

This recent investigation was made because of the persistence of typhoid fever in North Tonawanda; eighteen cases having been reported from the first of January to the third week in June, eleven of which occurred since March 7. Mr. C. M. Baker, assistant engineer, inspected the plant and collected samples of water for analyses from several points in the city on July 2, 1915.

The apparatus now being used by the city is of the type manufactured by the Electro Bleaching Gas Company. The flow of chlorine from the cylinder to the absorption tower is controlled by regulating valves and orifices. The rate or amount of chlorine being used is indicated only by a gauge which reads in ounces per hour, no scales being provided to check the amount of chlorine used by the loss of weight in the cylinders. The concentrated chlorine solution from the absorption tower is applied to the water in the conduit leading from the river to the pump well. The apparatus is enclosed in a small brick building constructed especially for this purpose and located just to the west of the pump well. Steam coils are provided in the building to assist in maintaining a constant temperature. There is no automatic control, the rate of applying the chlorine depending entirely upon the regulation of the control valve by the attendant.

When the Department first began the operation of its plant at North Tonawanda chlorine was applied at an average rate of .35 parts per million but this was gradually reduced to .25 parts per million. The latter rate gave very satisfactory results but it was evidently about the minimum that could be used and still give satisfactory bacterial efficiency at all times. Furthermore, the control valve was regulated at various times during the day so as to apply the chlorine practically proportionally to the amount of water being pumped, the average rate during the night being 10 pounds per 24 hours and during the day 16 pounds.

It was stated at the time of the recent inspection that the instructions given to the attendant by the representative of the company who installed the new plant were, that the control gauge should be set at between 5 and 6 ounces per hour to give satisfactory results. At the time of the inspection the gauge was set at 5 ounces per hour, which is equivalent to 7½ pounds of chlorine per day, corresponding to .15 parts per million of chlorine (about one-half of the amount necessary to obtain satisfactory results), when based upon an average water consumption of 6,000,000 gallons daily. No attempt is now made to vary the rate of applying the chlorine with the

variations in water consumption. Computing the actual rate at which chlorine has been applied to the water from the amount that has been used since the plant was installed, and the actual amount of water pumped shows that instead of applying .15 parts per million, as is indicated by the gauge on the apparatus, a much less amount has been applied. The record of operation of the plant together with the amount of chlorine actually used is indicated in the following table:

Chlorine cylinder connected	Chlorine applied pounds	Days to consume cylinder of chlorine	Average pounds of chlorine used per day	Average daily water consumption (gallons)	Average parts per million of chlorine used
March 6	....	....	....	....	....
March 28	104	20*	5.20	6,354,000	.10
April 23	101	26	3.88	6,153,000	.08
May 25	97	32	3.03	5,879,000	.06
June 27	101	33	3.06	6,036,000	.06

* Two days deducted for time plant was being repaird.

These records show clearly that only about ¼ the amount of chlorine is being applied to the water that should be used to assure satisfactory results at all times. The rate of the water consumption during the twenty-four hours ranges approximately from five million to seven million gallons which results in reducing the amount of chlorine at certain times to .05 parts per million or ⅕ the required amount. Experience and investigations have shown that such a small amount of chlorine has very little if any effect on the bacteria in the water and consequently it is possible that with the present method of operating the plant very little benefit is derived from it.

The efficiency of the chlorine treatment when using an average of .25 parts per million of chlorine and properly regulating the chlorine proportional to the amount of water consumed and also the inefficiency of the treatment as being applied and controlled at the time of the inspection is shown by the following bacterial analyses of samples collected before the chlorine was applied to the water, during the time the plant was being operated by a representative of the Department in 1914, and also at the time of the recent inspection.

Date col-lected	Amount of chlorine being applied (Parts per million)	Bacteria per c.c.	10 c.c.	1 c.c.	1/10 c.c.
1914	SAMPLES COLLECTED FROM PUMP OR PUMP WELL				
Nov. 11	None	750	+	+	+
Nov. 13	.25 or more	50	+	—	—
Nov. 17	.25 or more	20	—	—	—
Nov. 20	.25 or more	50	—	—	—
Nov. 23	.25 or more	7	—	—	—
Nov. 27	.25 or more	30	—	—	—
Dec. 2	.25 or more	30	—	—	—
1915					
July 13	.06	450	+	+	—
1914	SAMPLES COLLECTED FROM TAP OPPOSITE PUMP NO. 1				
Nov. 11	None	1,200	+	+	+
Nov. 13	.25 or more	50	—	—	—
Nov. 17	.25 or more	35	—	—	—
Nov. 20	.25 or more	15	—	—	—
Nov. 23	.25 or more	110	+	+	....
Nov. 27	.25 or more	300	+	—	....
Dec. 2	.25 or more	240	+	—	....
1915					
July 13	.06	14,000	+	+	+

Date collected	Amount of chlorine being applied (Parts per million)	Bacteria per c.c.	10 c.c.	1 c.c.	1/10 c.c.
1914	SAMPLES COLLECTED FROM TAP CORNER MAIN AND THOMPSON STREETS				
Nov. 11	None	1,400	+	+	+
Nov. 13	.25 or more	20	—	—	—
Nov. 17	.25 or more	20	—	—	—
Nov. 20	.25 or more	15	—	—	—
Nov. 23	.25 or more	5	—	—	—
Nov. 27	.25 or more	30	—	—	
Dec. 2	.25 or more	20	—	—	
1915					
July 13	.06	800	+	+	—
1914	SAMPLES COLLECTED FROM TAP AT NO. 393 GOUNDRY STREET				
Nov. 11	None	180	+	+	+
Nov. 13	.25 or more	30	—	—	—
Nov. 17	.25 or more	90	—	—	—
Nov. 20	.25 or more	30	—	—	—
Nov. 23	.25 or more	60	—	—	
Nov. 27	.25 or more	750	—	—	
Dec. 2	.25 or more	20	—	—	
1915					
July 13	.06	89,000	+	+	+
1914	SAMPLES COLLECTED FROM TAP AT NO. 644 OLIVER STREET				
Nov. 11	None	500	+	+	+
Nov. 13	.25 or more	100	—	—	—
Nov. 17	.25 or more	30	—	—	—
Nov. 20	.25 or more	15	—	—	—
Nov. 23	.25 or more	22	—	—	
Nov. 27	.25 or more	400	—	—	
Dec. 2	.25 or more	30	—	—	
1915					
July 13	.06	70,000	—	—	—

+ Present. — Absent.

These analyses show:

1. That the samples collected before chlorine was applied to the water contained from 180 to 1,400 bacteria per c. c. and that the B. coli type were present in all samples in quantities as small as 1/10 c. c.

2. That the samples collected during the time the Department was operating the chlorination plant and when .25 parts per million or more of chlorine was being applied, contained from 7 to 750 bacteria per c. c. and that the B. coli type were present in only one of the 10 c. c. samples taken from the pump well, and in a 10 and 1 c. c. samples collected from the tap at the pumping station but that they were in no case present in any of the samples collected from the mains in the city proper. It is thus apparent that the occasional presence of B. coli in the samples collected at the pumping station was due to the fact that the chlorine had had insufficient time to act upon them.

3. That the samples collected during the recent investigation contained from 800 to 89,000 bacteria per c. c. and that the B. coli type were present in 1/10 c. c. inoculations of samples collected from the tap at the pumping station and at 393 Goundry street; in the 1 c. c. inoculations of samples collected from the pump well and at the corner of main and Thompson streets; but that they were not present in the sample collected at 644 Oliver street.

From these results it may be concluded that although the water supply from the Niagara river is very badly polluted the bacterial content may be removed almost entirely by the proper application of liquid chlorine. However, with the present method of operating the chlorination plant, now installed at North Tonawanda, the treatment is decidedly ineffective because of

the insufficient amount of chlorine applied and because the rate of applying the chlorine is not varied in proportion to the rate of water consumption. Furthermore the rate of chlorine application indicated by the gauge is not checked by the loss of weight in the cylinder, thereby causing some uncertainty as to the actual amount of chlorine used.

In view of the above and to assure more effective operation of the plant I beg to make the following recommendations to be acted upon by the city officials.

1. That chlorine equivalent to not less than .25 parts per million by weight be applied to the water at all times.
2. That the amount of chlorine applied be varied in proportion to the amount of water being pumped;
   (a) By the attendant frequently regulating the control valves or preferably,
   (b) By installing an automatic control.
3. That scales be provided upon which to set the chlorine cylinder in order that the weight of chlorine in the cylinder may be recorded at regular intervals during the day, thereby affording opportunity for checking the accuracy of the control apparatus.

Respectfully submitted,

THEODORE HORTON,
Chief Engineer

ALBANY, N. Y., *August* 13, 1915

NORWOOD

HERMANN M. BIGGS, M. D., *State Commissioner of Health:*

A reinspection of the public water supply of Norwood was made on July 6, 1915, by Dr. B. R. Wakeman, sanitary supervisor of District "B." A previous investigation of this supply was made in 1912 by the Engineering Division, a full report of which will be found on page 709 of the thirty-third annual report of this Department.

The public water supply of Norwood is derived by pumping from the Raquette river just above the dam of the Norwood Paper Co. in the western part of the village. The water works system remains practically the same as at the time of the previous inspection except that a larger and more modern pump has been installed at the pumping station. The water works are owned and operated by the village.

The Raquette river above Norwood has an estimated watershed area of 1,025 square miles with a total population of about 15,400, or 15 per square mile. A population of about 4,000 discharges raw sewage into the Raquette river above Norwood, 3,000 of which is at the village of Potsdam, six miles above Norwood. In addition the stream receives considerable pollution due to industrial wastes from various pulp mills and other industries above the village. The insanitary condition of the supply is generally recognized and it is claimed that the supply is not used by the public for drinking purposes. Drinking water is obtained from private wells and bottled spring water.

At the time of the previous report it was pointed out that the supply was grossly polluted with domestic sewage and trade wastes and that without purification it was not safe for household purposes. It was also pointed out that the use of private and semi-public wells as a source of drinking supply was open to dangers attendant upon the use of wells in thickly populated communities. It was, therefore, recommended:

1. That the Board of Water Commissioners of the village of Norwood take steps to improve the sanitary quality of the public water supply by the installation of some approved method of purifying the present Raquette river supply or by seeking and installing a new, safe and adequate source of water supply.

2. That the village obtain the services of a competent engineer to fully investigate the question of public water supply and advise as to the most expedient and economical means of providing the village with a safe and acceptable water.

From the report of Dr. Wakeman it appears that none of these recommendations have been carried out, although repeated demands have been made by the health officer and sanitary supervisor to induce the board of water commissioners to secure a competent sanitary engineer to advise the board with respect to the improvement of the supply.

At the time of his inspection samples of water were collected by Dr. Wakeman and the results of the analyses of these samples together with others made in the past by the Division of Laboratories and Research will be found in the appended table.

These analyses show a highly colored water, at times very turbid and moderately soft. The total bacterial counts are very high and fecal organisms of the B. coli type are practically always present in samples as small as 1 c. c. and frequently present in 1/10 c. c. These analyses taken in conjunction with the known conditions upon the watershed show clearly the extremely unsatisfactory sanitary quality of the supply and its absolute unfitness for a public water supply.

In view of these facts, the following conclusions may be drawn:

1. That the Board of Water Commissioners of Norwood have apparently taken no steps toward carrying out the recommendations of this Department toward securing a satisfactory water supply.

2. That the present water supply of Norwood derived from Raquette river only six miles below the sewer outlets of Potsdam, is absolutely unfit and extremely dangerous for a public water supply.

3. That, although the supply is not ordinarily used for drinking purposes, its availability renders it liable to occasional use for drinking and to frequent use for culinary purposes. Consequently the mere existence of such a dangerously contaminated supply is a constant menace to the health of the community.

I would, therefore, recommend:

1. That the Board of water Commissioners give immediate attention to the previous recommendations of this Department.

2. That pending the installation of adequate purification facilities for their present supply or the development of a new supply of satisfactory quality, the village trustees install and operate a liquid chlorine apparatus for the sterilization of the present supply.

Respectfully submitted,

THEODORE HORTON,

Chief Engineer

ALBANY, N. Y., *September* 16, 1915

RESULTS OF WATER ANALYSES

Abbreviations used to describe odors of water: 0, none; 1, very faint; 2, faint; 3, distinct; 4, decided; 5, string; 6, very strong; a, aromatic; d, disagreeable; e, earthy; f, fishy; g, grassy; m, musty; v, vegetable

Municipality	County	Source of sample	Date of collection	Physical				Chemical (Parts per Million)											Bacteriological			
						Odor		Solids			Nitrogen as—						Hardness			B. Coli Type + = present — = absent		
				Color	Turbidity	Cold	Hot	Total	Loss on ignition	Mineral residue	Free ammonia	Albuminoid ammonia	Nitrites	Nitrates	Oxygen consumed	Chlorine	Total	Alkalinity	Bacteria per c.c.; gelatin 20°, 48 hours	10 c.c.	1 c.c.	1-10 c.c.
Norwood	St. Lawrence	Tap, public supply	2/12/12	45	Tr.	....	....	86	40	46	.020	.110	Tr.	0.20	20.0	0.27	16.9	11.0	......	......	......	......
Norwood	St. Lawrence	Tap, public supply	3/15/12	40	Cl.	....	....	73	33	40	.028	102	.002	.010	22.0	0.75	24.7	12.0	400	+	+	+
Norwood	St. Lawrence	Tap, public supply	4/19/12	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	1,100	+	+	+
Norwood	St. Lawrence	Tap, public supply	9/ 7/12	70	2	....	....	110	38	72	.004	.138	.001	0.08	21.6	0.62	33.8	17.0	240	+	+	—
Norwood	St. Lawrence	Tap, public supply	10/25/12	55	10	....	....	81	45	36	.024	.190	Tr.	0.08	24.4	0.50	24.7	10.0	800	+	+	+
Norwood	St. Lawrence	Tap, public supply	12/ 6/12	55	5	....	....	60	35	25	.020	.132	.001	0.06	17.2	0.75	20.8	19.0	1,000	+	+	—
Norwood	St. Lawrence	Tap, public supply	1/10/13	55	Tr.	....	....	61	....	....	.018	.112	.001	0.12	12.0	0.50	18.3	12.0	400	+	+	—
Norwood	St. Lawrence	Tap, public supply	2/13/13	45	Tr.	....	....	51	....	....	.010	.132	Tr.	0.20	13.2	0.25	16.9	7.0	1,000	+	+	—
Norwood	St. Lawrence	Tap, public supply	3/27/13	45	3	....	....	39	....	....	.028	.112	Tr.	0.10	7.6	1.00	14.3	3.0	1,900	+	+	—
Norwood	St. Lawrence	Tap, public supply	5/ 8/13	55	Tr.	....	....	56	....	....	.004	.120	Tr.	0.07	13.6	0.50	16.9	9.0	400	+	+	+
Norwood	St. Lawrence	Tap, public supply	6/19/13	60	15	....	....	77	....	....	.004	.162	Tr.	0.06	18.4	0.25	16.9	10.0	400	+	+	+
Norwood	St. Lawrence	Tap, public supply	7/24/13	55	5	....	....	108	....	....	.018	.298	Tr.	0.06	18.8	0.87	24.7	14.0	1,000	+	+	—
Norwood	St. Lawrence	Tap, public supply	5/13/14	40	10	1 v.	1 v.	41	24	17	.008	.120	.001	0.08	10.8	0.50	14.3	5.0	375	3+0—	2+1—	0+3—
Norwood	St. Lawrence	Tap, public supply	6/ 6/15	25	3	3 v.	3 v.	68	45	23	.006	.090	.001	2.20	32.0	1.00	19.5	10.0	140	3+0—	3+0—	1+2—
Norwood	St. Lawrence	Tap, public supply	6/ 6/15	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	750	3+0—	3+0—	2+1—

OLEAN

HERMANN M. BIGGS, M. D., *State Commissioner of Health:*

A reinspection of the public water supply of the city of Olean was made on October 14, 1914, by Dr. J. J. Mahoney, sanitary supervisor of District "M." Previous investigations of the supply were made by the Engineering Division in 1909 and 1911, reports of which will be found on page 247 of the thirtieth annual report of this Department and on page 940 of the thirty-third annual report.

The present water supply of Olean is derived from 16 eight-inch wells located in the southern part of the city in low land near the northern bank of the Allegany river. From these wells the water is pumped to a dug well, known as the Cook well, located on the southern bank of the river directly opposite. From this latter well, the water is pumped to the distributing reservoir on a hill south of the pumping station. The driven wells are 75 feet deep, driven through impervious clay strata into water-bearing gravel. The Cook well is 15 feet in diameter, 45 feet deep, and lined with brick. Eight of the driven wells have been in service since August 1, 1913, only. Formerly, there were one hundred or more driven wells of small diameter connected with the system, but these have been abandoned since the construction of the larger wells. The description of the water works system in general remains practically the same as described in the earlier reports.

On account of the flooding of the river banks in the vicinity of the wells there has been, at times, a certain amount of active contamination of the water supply. In the fall of 1914 there were some six or seven cases of typhoid fever in the city, the causation of which was strongly suspected to be the contamination of the water supply.

The driven wells are located very close to the bank of the river, but on account of the impervious strata of clay, it seems probable that, under ordinary conditions, river water does not reach the wells. The probability is that the only time river water reaches these wells is during periods of flood when leakage occurs down alongside the pipe casings. Near the Cook well there is a school house with outside privy of the ordinary type located about 120 feet south of the well, the natural slope of the ground being from the privy to the well.

The earlier reports pointed out very clearly and specifically the contamination to which the supply is subject at times when flood water covers the area adjacent to the well. Recommendations were made in these reports in regard to the protection of the various wells against contamination and those made in the 1911 report are as follows:

> 1. That the water board arrange for an expert examination of the driven well system to determine what possibility exists of contamination of the well waters by the river water at times of flood.
>
> 2. That, in case such examination shows any defects in the driven well system which would make possible the pollution of the well waters by means of the overflow of the river water, effective steps be taken to minimize this danger either by diking, by raising the walls of the well chamber or by such other means as may be found expedient.

The construction of the new wells has apparently been carried out with a view to obtaining a supply free from contamination, although there is no particular evidence that the city authorities have made other attempts to carry out the recommendations of this Department.

Bacteriological analyses made in October, 1914, by Dr. Hill of Buffalo, showed a bacterial content of 175 per c. c. and organisms of the B. coli type present in 1 c. c., thus indicating considerable active contamination. The results of analyses made by the Division of Laboratories and Research are given in the appended table. These analyses show a water at times slightly colored, usually clear, although occasionally turbid, and very hard. The total number of bacteria is frequently high, although this may be due in the

case of several of the analyses to the length of time required for the samples to reach the laboratory. Organisms of the B. coli type are usually absent, although they have been occasionally present in samples as small as 1 c. c. It is evident from these analyses that the contamination which occurs is sporadic in origin.

In view of the above facts, the following conclusions may be drawn:

1. That the specific recommendations of this Department have apparently not been carried out by the local authorities, although the construction of new wells is evidently an attempt to secure a supply free from contamination.
2. That the driven wells and the Cook well are both open to accidental contamination at times of flooding of the low land in the vicinity by the polluted waters of the Allegany river.
3. That the privy at the school house near the Cook well is a possible source of contamination of the waters in that well.
4. That, under different hydrostatic conditions of ground water and draft upon the wells, it is possible that more extensive and continuous contamination of the wells may occur.

I would, therefore, recommend:

1. That the Board of Water Commissioners take immediate steps to prevent possible contamination of the water supply.
   (a) By carefully protecting each well from the possibility of leakage of surface water into it.
   (b) By flood control methods in accordance with the recommendations of the previous reports.
2. That the Board of Water Commissioners remove the privy near the Cook well to a distance of at least 500 feet from the well or else provide it with watertight containers, the contents of which shall be systematically removed and properly disposed of.
3. That the city authorities have regular and frequent analyses made of the supply in order to detect at any time the presence of active contamination.
4. That, in case the analyses, after the carrying out of the improvements of recommendation No. 1, show that these measures are ineffective to prevent contamination, the Board of Water Commissioners consider abandoning the wells and securing a new supply of unquestioned sanitary quality or else, if practicable, install apparatus for the sterilization of the supply with liquid chlorine.

Respectfully submitted,

THEODORE HORTON,

Chief Engineer

ALBANY, N. Y., *June* 11, 1915

RESULTS OF WATER ANALYSES

Abbreviations used to describe odors of water: 0, none; 1, very faint; 2, faint; 3, distinct; 4, decided; 5, strong; 6, very strong; a, aromatic; d, disagreeable; e, earthy; f, fishy; g, grassy; m, musty; v, vegetable

Municipality	County	Source of sample	Date of collection	Physical: Color	Physical: Turbidity	Physical: Odor: Cold	Physical: Odor: Hot	Chemical (Parts per Million): Solids: Total	Solids: Loss on ignition	Solids: Mineral residue	Nitrogen as: Free ammonia	Nitrogen as: Albuminoid ammonia	Nitrogen as: Nitrites	Nitrogen as: Nitrates	Oxygen consumed	Chlorine	Hardness: Total	Hardness: Alkalinity	Bacteriological: Bacteria per c.c. gelatin 20°, 48 hours	B. Coli Type (+ present, − absent): 10 c.c.	1 c.c.	1-10 c.c.
Olean	Cattaraugus	Tap, public supply	4/12/12	10	3		..	176	31	145	.010	.050	.001	0.26	0.70	13.0	134	138	70			
Olean	Cattaraugus	Tap, public supply	7/24/12	8	7		..	217	24	193	.004	.028	.001	0.52	0.60	13.1	154	153	20	+		
Olean	Cattaraugus	Tap, public supply	9/26/12	..	....		..	....	..	....	....	....	.003	....	....	12.8	156	153	500			
Olean	Cattaraugus	Tap, public supply	11/14/12	5	Tr.		..	211	18	193	.012	.058	.001	0.50	1.00	12.5	151	.....	2,200			
Olean	Cattaraugus	Tap, public supply	12/16/12	Tr.	Cl.		..	217	22	195	.010	0.28	.003	0.50	0.90	12.1	171	153	6,100			
Olean	Cattaraugus	Tap, public supply	1/27/13	5	Cl.		..	192	..	....	.012	.046	Tr.	0.50	0.60	11.8	126	137	500			
Olean	Cattaraugus	Tap, public supply	2/24/13	Tr.	Cl.		..	222	..	....	.014	.038	.001	0.50	0.80	12.3	150	155	40			
Olean	Cattaraugus	Tap, public supply	4/3/13	Tr.	Cl.		..	171	16	155	.018	.024	.001	0.40	0.80	11.0	126	125	130	+	+	
Olean	Cattaraugus	Tap, public supply	4/7/13	Tr.	Cl.		..	201	..	....	.010	.020	.001	0.40	1.10	12.0	143	143	180			
Olean	Cattaraugus	Tap, public supply	5/26/13	2	Cl.		..	224	..	....	.004	.032	.003	0.54	0.30	12.8	151	156				
Olean	Cattaraugus	Tap, public supply	7/14/13	5	1		..	217	..	....	.006	.040	.002	0.36	1.30	13.0	154	138	100			
Olean	Cattaraugus	Tap, public supply	11/11/13	..	....		..	....	..	....	....	....	....	....	....	......	......	......	210	−	−	
Olean	Cattaraugus	Tap, public supply	11/11/13	..	....		..	....	..	....	....	....	....	....	....	......	......	......	70		−	
Olean	Cattaraugus	Tap, public supply	4/17/14	Tr.	5	v	v	204	27	177	.024	.068	.001	0.30	1.10	10.5	100	131	*1,300			
Olean	Cattaraugus	Tap, public supply	8/18/14	..	....		..	....	..	....	....	....	....	....	....	......	......	......	*3,500		−	
Olean	Cattaraugus	Tap, public supply	10/14/14	..	....		..	....	..	....	....	....	....	....	....	......	......	......	*175,000	+		
Olean	Cattaraugus	Tap, public supply	10/14/14	..	....		..	....	..	....	....	....	....	....	....	......	......	......	10	−	−	
Olean	Cattaraugus	Tap, public supply	10/14/14	..	....		..	....	..	....	....	....	....	....	....	......	......	......	30		−	
Olean	Cattaraugus	Tap, public supply	11/30/14	..	....		..	....	..	....	....	....	....	....	....	......	......	......	20	−	−	−

*Samples delayed in transit

OWEGO

HERMANN M. BIGGS, M.D., *State Commissioner of Health:*

A reinspection of the public water supply of Owego was made on November 17, 1914, by Dr. H. H. Crum, sanitary supervisor of District "R." The following information relative to the sanitary condition of the supply at that time is based upon data furnished by him. A full report on a previous investigation of this supply made by the engineering division in 1912 will be found on page 714 of the thirty-third annual report of this Department.

The public water supply of Owego is derived from two sources: Barnes creek, an upland stream, and secondly from two large shallow wells situated on low land in the southwestern part of the village. The creek supply after treatment by gravity mechanical filters is distributed by gravity to the village. The well supply is pumped directly into the distribution system against a head maintained by an equalizing and distributing reservoir on the side hill near the reservoir and filter plant of the creek supply. The description of the wells, pumping plant, distribution system, reservoirs and filter plant remains practically the same as given in detail in the report made in 1912. The water works are owned by the Owego Water Works Company.

At the time of the reinspection the creek supply was insufficient owing to the low flow in the stream. The watershed of this supply is approximately 2 square miles in area and its resident population may be estimated at 90, or about 45 per square mile. Conditions upon the watershed and in respect to the filter plant and its operation are no different than in 1912. At that time opportunities for pollution of the stream by surface wash from barnyards, manured fields, etc., existed. Furthermore, it was shown that in some respects the filter plant and its operation were open to serious objection. It was found that improper coagulation occurred due to the fact that no positive and approved devices were used to apply the sulphate of ammonia to the raw water. Furthermore, the sand filtering medium was too coarse and the method of operating the filters with no head over the sand surface was productive of bad distribution and unequal rates in the filter.

In respect to the well supply conditions were found by Dr. Crum to be practically unchanged. It was noted by him that land in the immediate vicinity of the wells was heavily manured. The earlier report also pointed out that the location of the wells in the inhabited section of the village made them open to the possibility of pollution, unpurified by passage through soil.

The recommendations made as a result of the investigation in 1912 are as follows:

1. That all barnyards and poultry houses be removed to a distance of not less than 100 feet from any stream tributary to the impounding reservoir. That all privy vaults shall be removed from such tributaries to a distance of not less than 75 feet. That all privies which may be located between the distance of 200 feet and 75 feet of such tributaries be provided with watertight removable containers and that the Owego Water Company see that any such containers are not allowed to overflow and that their contents are safely disposed of by burying or other suitable means at such distance from the reservoir or tributaries thereto as to prevent any possible pollution of the public water supplies.

2. That the efficiency of the mechanical filters be increased and their effective operation be more satisfactorily provided for by (a) installation of approved devices for positively controlling the coagulant solutions and applying them to the raw water by gravity flow. (b) Providing for applying a part of the coagulant solution to the settled water just prior to its passage to the filters. This is desirable in order that some of the hydrate "flock" will pass on to the filters and not be lost by the long period of settling in the coagulating reservoir. (c) Throttling the outlets of the filters at such times as they are operated at very low rates, in order to maintain a head of water at all times, over the sand surfaces.

(d) Making and keeping records of the physical, chemical and bacteriological tests which are customarily made of the raw and filtered waters in the most carefully operated filter plans.

3. That should it become necessary in order to maintain a satisfactory degree of efficiency under increased rate of filtration due to increased consumption and greater percentage of filtered water, a finer sand be used for filtering medium. The effective size of the present filtering medium is approximately 0.71 mm. In practice the best results are obtained by sand having an effective size between .3 mm. and .5 mm. The present sand is very uniform, however, having a uniformity coefficient of approximately 1.6.

4. That in view of the location of the wells used for public water supply and the possibility of their becoming polluted or infected by the nearby resident population that frequent analyses be made by the water company of the water from these wells, especially at times of high water, and that should the records of these analyses indicate at any time direct pollution of the water, that the wells be abandoned as a source of public water supply. Also that the wells be further safeguarded by removal of all manure piles and installation of watertight removable containers in all privies within an eighth of a mile of the pumping station.

5. That an area immediately surrounding the wells be fenced off so that stray animals cannot approach or enter on the immediate vicinity of the wells, and that the public be excluded from the area without permission.

6. That the wells be provided with conical or other suitable ventilated roofs to prevent pollution from the shoes of attendants reaching the water.

According to the report of Dr. Crum none of the above recommendations have been carried out except that monthly analyses are made of the well supply.

At the time of his inspection samples of water were collected by Dr. Crum and the results of the analyses of these samples together with others made in the past by the Division of Laboratories and Research will be found in the appended table.

From this table it will be seen that the water from the upland supply is somewhat colored, usually comparatively clear and fairly soft. The amount of carbonaceous organic matter is rather high and the chlorine content is about twice that normal for this region. The total number of bacteria are somewhat variable, at times high and organisms of the B. coli type present in quantities as small as 0.1 c. c.

The well water, on the other hand, is clear, colorless and very hard. The organic matter, indicated by oxygen consumed, nitrogen in the form of nitrates and the chlorine figures are high, indicating occurrence of organic contamination in the past that has become fairly well purified or oxidized by passage through the soil. The total number of bacteria are in some cases excessive and in others moderate or low and organisms of the B. coli type are found occasionally in 10 c. c. and only once in smaller quantities. Such results indicate that for the greater part of the time the contamination reaching the ground water supply tributary to the wells is comparatively well purified, but that at other times this purification is incomplete and active contamination of the well supply occurs.

In view of the above facts the following conclusions may be drawn:

1. That little if any action has been taken by the water works company to carry out the recommendations of this Department.

2. That the surface supply from Barnes creek is open to contamination due to surface wash from barnyards, pastures and manured fields.

3. That the filtration plant as described by the report of 1912 cannot be depended upon to produce a satisfactory degree of purification at all times and under all conditions unless the recommendations made in the previous report in respect to its operation are completely carried out.

which are 85 feet deep only and from which the suction lift is 11 feet. The suction lift in the 65 feet wells is about 13 feet.

The reservoir located on the hill above the pumping plant is 80 feet in diameter and has a capacity of 500,000 gallons. It is surrounded by a fence 6 feet high, the lower 2 feet of which are constructed of quarter inch mesh screen and the rest of 1 inch poultry netting. The intake at the reservoir is protected by means of a half inch mesh screen. In the valve house located just below the reservoir is another screen of ¼ inch mesh. The outlet from the reservoir to the mains is so provided with gate valves and check valves that the water in passing from the pumps to the reservoir by-passes the latter screen and discharges directly into the reservoir. Suitable valves are also provided for flushing out and cleaning the reservoir. The Assistant Engineer was informed that the reservoir is cleaned one or twice yearly as needed to prevent algae growths. There was some green moss growth in the reservoir at the time of the inspection but it was apparent that this condition was not then serious.

The mains consist of about 5½ miles of pipe ranging in size from 4 to 10 inches in diameter. There is only one dead end in the system. It was stated that the mains are flushed about every month. The water pressure in the village is about 90 pounds per square inch.

The nearest house is about 800 feet distant and is not in the direct line of probable ground water flow. A small stream flows near the wells which has its source in springs about ¼ of a mile from the wells. There are no houses nor inhabitants upon it. It is thus apparent that there is little, if any, opportunity for pollution of the well supply unless accidental or intentional.

The well of the Ingersoll-Rand Co. which is used as an auxiliary supply in case of fire is a dug well 22 feet deep and 5 feet in diameter. It is located in the center of the power house and is not covered but the opening is surrounded by a railing. The plant has a private sewer system which discharges the sewage without purification into the river. The nearest sewer is about 150 feet from the well and is constructed of tile. A barn located on adjoining property is only about 50 feet distant from the well and until shortly before the inspection a pigpen was maintained within 30 feet of the well and although the pigpen had been removed, the conditions in the vicinity were very insanitary at the time of the inspection. There is a very dense population within a radius of a few hundred feet of this well. The sewage of this population is disposed of by means of leaching cesspools and privies. It is thus apparent that considerable pollution reaches the ground water from which the supply is derived.

Samples of water were collected both from the village supply and from the well of the Ingersoll-Rand Co. and sent to the Division of Laboratories and Research for analysis, the results of which, together with those of previous analyses are recorded in the appended table.

The results of the analyses of samples of water collected from the village supply show, the presence of only a small amount of organic matter and in general a low bacterial content with organisms of the B. coli type nearly always absent. The nitrates 2.00 parts per million and the chlorine 7.50 parts per million which were found present in the sample of water collected from the well of the Ingersoll-Rand Co. indicate pollution as does also the high bacterial content of 3,000 per c. c. The absence of colon bacilli, however, indicate that this water has become partly purified during its passage through the soil.

As a result of this investigation I would conclude as follows:

1. That the water supply derived from the wells of the village supply is satisfactory in quality and adequate in quantity for the needs of the municipality and that the quality of the supply should continue to be satisfactory providing the wells are at all times properly protected against contamination.

2. That the auxiliary supply obtained at times from the well of the Ingersoll-Rand Co. is subject to considerable pollution, and therefore unsatisfactory in quality.

I therefore beg to offer the following recommendations to be acted upon by the village authorities:

1. That in case dwellings are erected in the vicinity of the present well supply of the village, great precautions be exercised in providing for the proper disposal of sewage and other wastes in order to avoid as far as possible the contamination of the ground water tributary to the wells.

2. That the village secure control of as much land as practicable immediately surrounding the wells in order that it may have the power to keep potential sources of contamination at a distance.

3. That the practice of using water pumped from the plant of the Ingersoll-Rand Co. as an auxiliary supply be discontinued and at such times as it is necessary to clean the resrvoir the water from the village well should be pumped continuously into the distributing system. In case it is found absolutely necessary to use occasionally the Ingersoll-Rand supply the village should purchase a chlorination apparatus for sterilization of this auxiliary supply with liquid chlorine.

Respectfully submitted,

THEODORE HORTON,
Chief Engineer

ALBANY, N. Y., *September* 28, 1915

RESULTS OF WATER ANALYSES

Abbreviations used to describe odors of water: 0, none; 1, very faint; 2, faint; 3, distinct; 4, decided; 5, strong; 6, very strong; a, aromatic; d, disagreeable; e, earthy; f, fishy; g, grassy; m, musty; v, vegetable

Municipality	County	Source of sample	Date of collection	Physical				Chemical (Parts Per Million)											Bacteriological			
						Odor		Solids			Nitrogen as—						Hardness			B. Coli Type (+ = present; — = absent)		
				Color	Turbidity	Cold	Hot	Total	Loss on ignition	Mineral residue	Free ammonia	Albuminoid ammonia	Nitrites	Nitrates	Oxygen consumed	Chlorine	Total	Alkalinity	Bacteria per c.c.; gelatin 20°, 48 hours	10 c.c.	1 c.c.	1-10 c.c.
Painted Post	Steuben	Tap, public supply	1/ 9/12	5	5	...	...	192	27	165	.004	.018	.001	0.04	0.40	1.00	160.0	145.0	50	—	—	—
Painted Post	Steuben	Tap, public supply	2/14/12	Tr.	Cl.	...	...	167	15	152	.010	.024	Tr.	0.16	0.58	1.50	142.8	143.0	120	+	—	—
Painted Post	Steuben	Tap, public supply	3/21/12	5	Tr.	...	...	176	22	154	.014	.018	Tr.	0.04	1.30	1.25	140.0	136.0	50	+	—	—
Painted Post	Steuben	Tap, public supply	10/ 8/12	5	Tr.	...	...	172	33	139	.004	.006	Tr.	0.04	0.80	1.50	134.2	133.0	12,500	—	—	—
Painted Post	Steuben	Tap, public supply	11/26/12	Tr.	Cl.	...	...	168	10	158	.016	.020	.001	0.06	0.30	1.75	140.0	139.0	20	—	—	—
Painted Post	Steuben	Tap, public supply	1/ 3/13	Tr.	Cl.	...	...	156	...	...	.010	.034	Tr.	0.02	0.30	1.75	108.6	137.0	70	—	—	—
Painted Post	Steuben	Tap, public supply	3/12/13	Tr.	Cl.	...	...	177	...	...	.006	.030	.001	0.02	0.50	1.50	114.2	138.0	...	—	—	—
Painted Post	Steuben	Tap, public supply	6/10/13	Tr.	Cl.	...	...	165	...	...	.014	.014	Tr.	0.02	0.20	2.00	117.2	133.0	10	—	—	—
Painted Post	Steuben	Tap, Dr. Shumway's resid'ce.	8/13/15	Tr.	Cl.	1 v.	1 v.	200	30	170	.006	.010	.001	0.40	0.10	2.00	142.8	133.0	15	0+3—	0+3—	0+3—
Painted Post	Steuben	Tap, 332 Delaware Ave.	8/13/15	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	30	0+3—	0+3—	0+3—
Painted Post	Steuben	Tap, 366 Oliver St.	8/13/15	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	20	0+3—	1+2—	0+2—
Painted Post	Steuben	Well, Ingersoll-Rand Co.	8/13/15	Tr.	Cl.	1 v.	1 v.	350	45	305	.004	.010	Tr.	2.00	0.20	7.50	228.5	170.0	3,000	0+3—	0+3—	0+3—

PALMYRA

Hermann M. Biggs, M.D., *State Commissioner of Health:*

A reinspection of the public water supply of Palmyra was made on September 19, 1915, by Dr. Isaac W. Brewer, sanitary supervisor of District "Q." Previous investigations of this water supply were made by the Engineering Division in 1910 and 1913, the full reports of which will be found on page 750 of the thirty-second annual report of this Department and on page 559 of the thirty-fourth annual report.

The water supply is derived from two large wells located at different points in the village. One of these wells, known as the upper well, is in the southeastern part of the village and the other, or lower well, is about 1½ miles east of the village in low land bordering a stream. The description of the surroundings of these wells and the equipment of the pumping stations is the same as given in detail in the earlier reports. The water from the lower well is treated with hypochlorite of lime by means of a rather crude dosing arrangement. The water works are owned and operated by the village.

The sanitary surroundings of the upper well are fairly satisfactory although at the time of the inspection in 1913 it was noted that an insanitary earth vault privy was located a short distance from the well. The conditions at this well remain practically the same as at the time of the earlier inspection.

The lower well apparently derives a large portion of its supply by infiltration from the nearby stream. This stream has a watershed of about 6 square miles upon which there are numerous dwellings and undoubtedly numerous possibilities for contamination.

The report of 1913 arrived at the following conclusions:

> 1. That while the location of the upper well is not the best possible, being below an inhabited building, it has in the past furnished a safe and satisfactory supply and with careful oversight and protection from careless or accidental pollution should continue to supply a satisfactory water. The privy vault at the upper pumping station should be removed to another location or put in such condition as to preclude the possibility of any pollution of the soil.
>
> 2. That the present lower well is in an undesirable location and at times receives polluted water from the nearby stream by seepage and possibly by flooding during high water. It should be abandoned as a source of supply and a new source or sources be developed, or else if this pumping station is to be retained it should take its water entirely from the spring to the west now tributary to the well, or other safe source and should be independent of the ground waters in the immediate vicinity of the pumping station.
>
> 3. That the present plant for the application of hypochlorite at the lower station does not permit of a careful and uniform treatment of this supply by the proper quantities of hypochlorites. This apparatus should be improved so that small quantities of hypochlorite solution free from insoluble matters can be accurately and uniformly applied and thoroughly mixed with all the water delivered by the pump.

From Dr. Brewer's report it appears that the village authorities are looking for a better water supply and that they have employed engineers at different times to look into the matter. No final conclusion, however, as to a method for developing a better supply has been reached.

At the time of his inspection, Dr. Brewer collected samples from the wells and from a tap in the village and the results of the analyses of these samples together with others made in the past by the Division of Laboratories and Research will be found in the appended table.

These analyses show the water from both wells to be clear, colorless and very hard. The figures for free and albuminoid ammonia are moderate although those for nitrates and chlorine are high indicating the occurrence of organic contamination of the ground water sources tributary to these wells.

The total bacterial counts are in some cases high and the occasional presence of fecal organisms of the B. coli type indicates active contamination of animal or human origin. In view of the above facts, the following conclusions may be drawn:

1. That the village authorities of Palmyra have carried out to some extent the recommendations of this Department.
2. That both wells from which the supply of Palmyra is derived are open to contamination from dwellings in the vicinity and in the case of the lower well from the infiltration of polluted creek water, the occurrence of such contamination being confirmed by the analytical results.
3. That the apparatus for the sterilization of the supply derived from the lower well is very crude and is apparently producing little beneficial effect upon the quality of the water.

I would therefore recommend:

1. That the village authorities give their immediate attention to the desirability of securing a new water supply adequate in quantity and of a satisfactory sanitary quality and to this end employ a competent sanitary engineer to prepare detailed plans for the development of such a supply.
2. That, pending the securing of a new and satisfactory supply, the village improve the sanitary conditions in the vicinity of the upper well and substitute suitable liquid chlorine apparatus for sterilizing the lower well supply in place of the present crude and inefficient hypochlorite plant.

Respectfully submitted,

THEODORE HORTON,
Chief Engineer

ALBANY, N. Y., *December* 16, 1915

REPORT OF WATER ANALYSIS FOR PALMYRA

Source	Tap	Tap	Upper well	Lower well	Tap	Upper well	Lower well
Collected on	4/23/14	6/23/14	6/23/14	6/23/14	8/30/15	8/30/15	8/30/15
Color	Trace	....	Trace	Trace	....	Trace	Trace
Odor, hot	2a	....	1v	1v	....	1v	1v
Odor, cold	2a	....	1v	1v	....	1v	1v
Turbidity	Trace	....	Clear	Trace	....	Clear	Clear
Solids, total	333	....	361	438	....	365	270
Loss on ignition	66	....	89	71	....	27	80
Mineral residue	267	....	272	367	....	338	190
Ammonia, free	.020	....	.002	.004	....	Trace	Trace
Ammonia, alb.	.036	....	.020	.028	....	.014	.010
Nitrites	.001	....	.001	.001	....	.003	.004
Nitrates	3.60	....	4.60	5.60	....	4.00	2.00
Oxygen consumed	1.30	....	1.20	1.40	....	0.90	0.40
Chlorine	7.62	....	8.50	3.50	....	10.50	4.00
Hardness, total	257	....	265	257	....	265	182
Alkalinity	197	....	215	178	....	236	153
Bacteria per c.c.	15	80	70	120	10	15	50
B. coli type 10 c.c.	—	+	+	+	—	—	+
B. coli type 1 c.c.	—	—	—	—	—	—	—
B. coli type 1/10 c.c.	—	—	—	—	—	—	—

Results are expressed in parts per million. + Present. — Absent.

Abbreviations used to describe odors of water: 0, none; 1, very faint; 2, faint; 3, distinct; 4, decided; 5, strong; 6, very strong; a, aromatic; d, disagreeable; e, earthy; f, fishy; g, grassy; m, musty; v, vegetable.

REPORT OF WATER ANALYSIS FOR PALMYRA

Source		Tap	Upper well	Lower well
Collected on		9/29/15	9/29/15	9/29/15
Color		Trace	Trace	Trace
Odor, hot		1v	1v	1v
Odor, cold		1v	1v	1v
Turbidity		Clear	Clear	Clear
Solids, total		328	399	306
Loss on ignition		17	85	40
Mineral residue		311	314	266
Ammonia, free		.008	.002	.002
Ammonia, albuminoid		.026	.012	.012
Nitrites		.003	.001	.001
Nitrates		1.60	5.00	4.00
Oxygen consumed		1.60	2.20	2.00
Chlorine		7.50	8.75	3.75
Hardness, total		265	4.50	2.57
Alkalinity		2.61	240	178
Bacteria per c.c.		1,300	1,500	1,100
B. coli type	10 c.c.	2+1—	1+2—	2+1—
	1 c.c.	1+2—	0+3—	1+2—
	1/10 c.c.	0+3—	0+3—	0+3

Results are expressed in parts per million. + Present. — Absent.
Abbreviations used to describe odors of water: 0, none; 1, very faint; 2, faint; 3, distinct; 4, decided; 5, strong; 6, very strong; a, aromatic; d, disagreeable; e, earthy; f, fishy; g, grassy; m, musty; v, vegetable.

PIERCEFIELD

HERMANN M. BIGGS, M.D., *State Commissioner of Health:*

A reinspection of the public water supply of Piercefield was made on July 15, 1915, by Dr. B. R. Wakeman, sanitary supervisor of District "B." A previous investigation of this supply was made in 1912 by the Engineering Division, a full report of which will be found on page 724 of the thirty-third annual report of this Department.

Piercefield is an unincorporated village with a population of about 500 located in the southeastern part of St. Lawrence county. The public water supply is derived from Racquette river at a point just above the dam of the International Paper Company. The water is passed through a coagulation and subsidence basin, then through a gravity mechanical filter and after storage in a small clear water basin is pumped directly to the village mains. The description of the plant and water works system in general remains practically the same as given in detail in the earlier report with the exception that a steam pump has been installed to lift the water upon the filters when the water level in the forebay is low. The sand in the filters has also been removed and replaced by a new and larger quantity. The water works are owned and operated by the International Paper Company.

The watershed of the Racquette river above the water works intake is approximately 717 square miles. The total population upon this watershed above Piercefield is estimated at about 6.500 or approximately 9 per square mile. In summer the total population is increased to about 8,000. The possibilities for pollution of the river remain the same as described in full in the earlier report, the principal source of contamination being the discharge of sewage from the village of Tupper Lake, 6 miles above Piercefield. The conclusions of the earlier report in respect to the sanitary quality of the supply were summarized as follows:

1. That while sufficient numbers of chemical analyses are not available to judge of the physical and esthetic qualities of the water of the Racquette river at Piercefield during all seasons, it is evident from the bacteriological examinations that it shows at times evidence of dangerous pollution from the sewage discharged into the river above and principally at Tupper Lake.

2. That in essential features and as well as could be determined by a necessarily brief inspection the design and construction of the filter plant is in accordance with ordinary and fairly good practice.

3. That the filter plant is indifferently operated and not subject to the care and precision necessary in the efficient operation of all mechanical filters.

4. That the interruption of the operation of the filter plant, especially for long periods during low water, is a menace to the health of the village.

It was, therefore, recommended at that time:

1. That the International Paper Company be required to increase the efficiency of the filter plant for the public water supply by (a) making and keeping records of the physical, chemical and bacteriological tests which are customarily made of the raw and filtered waters in an efficiently operated filter plant; (b) equipping the filters with the necessary gauges and similar appurtenances to allow of a more positive and efficient operation; (c) operating the plant at all times under the direct supervision of a skilled attendant; (d) enclosing or otherwise protecting the chemical mixing plant in such a way as to make the preparation and control of the coagulant solutions convenient with reference to proper light, space and accessibility.

2. That the International Paper Company take immediate steps to improve the arrangement of the works by the installation of low lift pumps in such a manner that all the public water supply shall be filtered at all times.

From the report of Dr. Wakeman, it appears that recommendation No. 2, only, has been acted upon. The company, however, is considering the development of a new gravity supply from a stream in the mountains about 1½ miles southeast of the village. A weir has been installed to measure this stream and if the supply proves adequate, a gravity system will be installed.

At the time of his inspection Dr. Wakeman collected samples of water before and after filtration and the results of the analyses of these samples together with others made in the past by Division of Laboratories and Research will be found in the appended table.

These analyses show clearly the unsafe sanitary quality of the untreated Racquette river water; the total bacterial counts being high and fecal organisms of the B. coli type being present in 1 c. c. inoculations. The results of the analyses of the samples of filtered water taken by Dr. Wakeman show a marked decrease in B. coli although the total bacterial counts are somewhat unreliable owing to the fact that the samples were two days in reaching the laboratory.

In view of the above facts the following conclusions may be drawn:

1. That the International Paper Company has carried out to some extent the recommendations of the previous report, although, apparently, the filter plant could be operated with greater care and efficiency.

2. That in view of the unsatisfactory quality of the raw water and the difficulty of purifying it with high efficiency at all times, the efforts of the company to obtain an uncontaminated gravity supply from the hills is a step in the right direction.

I would, therefore, recommend:

1. That pending the installation of this new supply, if such a course is decided upon, the company operate their filter plant in accordance with recommendations No. 1 of the report of 1912.

Respectfully submitted,

THEODORE HORTON,
Chief Engineer

ALBANY, N. Y., *September* 30, 1915

RESULTS OF WATER ANALYSES

Abbreviations used to describe odors of water: 0, none; 1, very faint; 2, faint; 3, distinct; 4, decided; 5, strong; 6, very strong; a aromatic; d, disagreeable; e, earthy; f, fishy; g, grassy; m, musty; v, vegetable

Municipality	County	Source of sample	Date of collection	PHYSICAL				CHEMICAL (PARTS PER MILLION)											BACTERIOLOGICAL			
						ODOR		SOLIDS			NITROGEN AS—						HARDNESS			B. COLI TYPE + = PRESENT — = ABSENT		
				Color	Turbidity	Cold	Hot	Total	Loss on ignition	Mineral residue	Free ammonia	Albuminoid ammonia	Nitrites	Nitrates	Oxygen consumed	Chlorine	Total	Alkalinity	Bacteria per c.c.; gelatin 20°, 48 hours	10 c.c.	1 c.c.	1-10 c.c.
Piercefield	St. Lawrence	Raw water	2/23/12	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	300	+	+	+
Piercefield	St. Lawrence	Filter water	2/23/12	5	Cl.	....	....	47	16	31	.044	.084	Tr.	0.16	4.40	0.75	14.3	5.0	110	+	—	—
Piercefield	St. Lawrence	Raw water, Racquette river	7/15/15	20	3	2 v.	2 v.	77	56	21	.006	.054	.001	0.08	10.20	0.25	11.1	6.0	*55,000	3+0—	3+0—	0+3—
Piercefield	St. Lawrence	Clear water, well	7/15/15	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	*6,100	0+3—	0+3—	0+3—
Piercefield	St. Lawrence	Tap, filter water	7/15/15	10	1	2 v.	2 v.	145	95	50	.004	.080	.001	0.02	6.00	0.75	29.9	4.0	*12,500	1+2—	0+3—	0+3—

* 2 days in transit.

PIKE

Hermann M. Biggs, M.D., *State Commissioner of Health:*

An investigation of the public water supply of the village of Pike was made on August 12, 1915, by Mr. M. F. Sanborn, assistant engineer. The inspector was assisted at the time of the inspection by the president of the village, Mr. Clinton Camp, and Mr. E. M. Shaddock, clerk. Mr. Camp is also in charge of the water works.

Pike is an incorporated village located in the southeastern part of Wyoming county about 40 miles southeast of Buffalo. It is in the valley of Wiscoy creek and is about 6 miles from Portageville, which is on the Pennsylvania railroad. The population at the time of the inspection was 344.

The public water supply is owned by the village and the water is used for both household purposes and for fire protection. The works were designed by Mr. F. K. Wing, civil engineer of Buffalo, and were constructed by Gray & Miller of Hornell in 1910 under the direction of Mr. Wing.

The water is obtained from two springs which are located about one mile west of the village. The surplus water from these springs flows into Wiscoy creek. From these springs the water flows to an open concrete reservoir and thence to the distributing mains of the village. About 138 people or 40 per cent. of the total population are served by this supply. The daily water consumption is unknown and there was no method by which the amount could be readily obtained. There are about 6 miles of water mains ranging from 4 to 8 inches in size. Of the 75 houses in the village 30 are served by the supply. The average pressure in the village is about 55 pounds per square inch. During several weeks of last year the supply had to be cut off from the houses due to shortage and it was stated that later a leak was found which was thereupon repaired and since that time the supply has been sufficient.

There is no system of sewage disposal in the village except local cesspools, septic tanks and privies.

One of the springs is protected by a concrete wall about 5 feet high and 5 feet square which extends about 1 foot above the ground. The spring is open and considerable algae growth was found. It is stated, however, that no trouble has been experienced as yet from tastes and odors. This spring has never been cleaned. The other spring lies just east of the reservoir and a pipe extends directly from the spring to the reservoir. This spring is entirely covered with earth and no evidence of the spring could be seen except the piping as it entered the reservoir from the spring. The reservoir is located about 100 feet from the road, is uncovered and is constructed of concrete. It is 40 feet by 70 feet in plan and 8 feet deep and has a capacity of about 168,000 gallons. The reservoir is said to be cleaned out once a year and the mains are flushed out three or four times a year.

The area of the watershed above these springs is comparatively small, although the area of the elevation of the springs from which water might be drawn is approximately one-third of a square mile. There are no houses or buildings above the spring except an old barn which has not been used for some years. The springs are located on the side of a small hill about 25 feet from a brook and 75 feet from the road. The soil consists chiefly of sand and gravel and the underlying rock is chiefly Chemung sandstone and shale.

At the time of the inspection a sample of water was obtained for bacterial examination and on August 17 another sample was obtained for both chemical and bacteriological examinations. The results of these analyses will be found in the following table:

WATER ANALYSIS FOR THE VILLAGE OF PIKE

Collected on		8/17/15	8/12/15
Collected from		Tap public supply	Tap at hotel
Color		Trace	
Odor, hot		1 v.	
Odor, cold		1 v.	
Turbidity		Trace	
Solids, total		122	
Loss on ignition		10	
Mineral residue		112	
Ammonia, free		.016	
Ammonia, albuminoid		.032	
Nitrites		.004	
Nitrates		1.00	
Oxygen consumed		0.50	
Chlorine		5.25	
Hardness, total		92.90	
Alkalinity		75.00	
Bacteria per c.c.		10	10
B. coli group	10 c.c.	Inoculations 2+1—	Inoculations 0+3—
	1 c.c.	Inoculations 0+3—	Inoculations 0+3—
	1/10 c.c.	Inoculations 0+3—	Inoculations 0+3—

From these analyses it will be seen that the water is practically clear and colorless and rather hard. Figures for nitrogen in its various forms show a certain amount of organic contamination which had, however, been well mineralized. The somewhat high chlorine figure also shows some pollution. The bacterial count of both samples is very low authough in the sample of August 17 bacteria of the B. coli group are found in 10 c. c. samples.

As a result of this investigation and of the analyses the following conclusions may be drawn:

1. That the public water supply of Pike is of a reasonably satisfactory sanitary and physical quality, although it is probable that the springs which form its source receive at times a certain amount of active contamination by the rapid percolation through the soil of highway drainage from the nearby road.
2. That the collection and storage of ground waters in an uncovered basin and reservoir makes possible the growth of algae which might give rise to tastes and odors.

I would therefore recommend for action by the village authorities:

1. That adequate drainage ditches be constructed to divert highway wash from the immediate vicinity of the springs.
2. That the open spring be thoroughly cleaned and both this spring and reservoir be covered to exclude sunlight in order to reduce the possibility of algae growths and also to prevent accidental or wilful contamination by chance visitors.

Respectfully submitted,
THEODORE HORTON,
Chief Engineer

ALBANY, N. Y., *October* 8, 1915

PINE HILL

HERMANN M. BIGGS, M.D., *State Commissioner of Health:*

An investigation of the public water supply of the village of Pine Hill was made on September 14, 1915, by Mr. Morton F. Sanborn, assistant engineer, who was assisted at the time of the inspection by Mr. R. W. Hill, superintendent of the water company, Mr. George E. Rose, president of the

village, and Mr. S. K. Clapp, assistant engineer of the board of water supply of New York city.

Pine Hill is an incorporated village in the northwestern part of the town of Shandaken in Ulster county. It is located on Birch creek, which is a tributary of Esopus creek and on the Ulster & Delaware railroad. The permanent population was estimated at about 450, while during the summer months this number is increased to approximately 2,500.

The public water supply is owned by the Pine Hill Water Company and the water works were designed by Mr. R. W. Hill and constructed by Mr. Hill and Mr. John Longyear in 1895. In 1900 an additional reservoir was constructed which is used only as a reserve supply for the village and continually by about six families.

The water is obtained chiefly from a spring located in the western part of the village. Water is also obtained from a brook flowing near the spring and an auxiliary supply is provided from a spring located in the southwestern part of the village. A tubular well has also been driven near the main spring although the water from this well has never been used. The water from the springs and brook is fed to the reservoir and distributed throughout the system by gravity. Water from the well will require pumping to the reservoir. Fire protection is provided in the village by hydrants placed in various localities.

The number of inhabitants served varies from 300 during the winter months to 2,000 during the summer. The average daily consumption is unknown and there was no method by which this could be readily obtained. Assuming 80 gallons per capita as an average the total daily consumption would vary from 24,000 gallons to 160,000 gallons.

There are about two miles of water mains varying from 4 to 6 inches in diameter. There are about 100 houses in the village, of which 70 are connected with the water supply and 5 of these are metered. The average pressure in the village is about 80 pounds.

There is no sewer system or method of sewage disposal in the village except cesspools and septic tanks.

The upper or main spring is located at the foot of a mountain in the western part of the village. This spring has a stone wall surrounding it and is well protected from surface wash. The water from this spring flows directly to the reservoir located nearby.

The principal intake from the brook is located at the lower side of the Ulster & Delaware R. R. as the creek passes through the culvert under the tracks. At this point a small depression was formed from which a pipe conveys the water to the reservoir. A supplementary intake is provided which leads from a small artificial pond located below the reservoir and from this point the water is fed directly to the mains in the village.

Close by the main spring a driven well was sunk, 6 inches in diameter and 140 feet deep. The soil in this neighborhood is chiefly of sand and gravel, although somewhat impervious to the passage of water. The underlying rock is principally shale.

It was planned that water from the well would be pumped by a nearby pumping station 10 by 20 feet in plan. The pumping equipment consists of one 3-inch deep well Rumsey pump operated by a 3 horsepower gasoline engine. This equipment has never been placed in commission and water from the well has not as yet been used.

The lower spring, which is located nearer the village, is situated part way up the side of a hill near the plant of a spring water bottling company. The water from this spring flows into a nearby reservoir which is used as an auxiliary supply and by about six houses directly connected to the reservoir.

The upper or principal reservoir is 20 feet by 28 feet in plan and 10 feet deep. It is constructed of stone masonry, is uncovered and is surrounded by a 6-foot corrugated iron fence. This reservoir has a capacity of approximately 42,000 gallons, which would give a storage period of about one-third of a day during the summer months. The lower reservoir is of the same construction, 30 by 50 feet in plan and 10 feet deep. This gives a capacity of

about 112,000 gallons, which would correspond to about two-thirds of a day's consumption during the summer. This reservoir is at an elevation about four feet lower than the main reservoir and, therefore, is not used ordinarily and the greater part of the water at the nearby spring overflows and finds its way into the brook. The small reservoir at the lower intake of the brook has a capacity of about 2,000 gallons; is open and unprotected from surface wash.

The area of the watershed above the main spring is comparatively small although the possible area from which it might draw water may be as great as three-quarters of a square mile. The lower spring also has a very small watershed although the area from which it might draw water may be as great as one-third square mile. The area tributary to the main intake of the creek is about one square mile and the supplementary intake lower down has only a small amount of additional watershed.

The main spring is protected from pollution while the supplementary spring is open and located by the side of a road. Above this supplementary spring near the railroad tracks is located the shipping station of the bottling works, at which place no sanitary conveniences are provided and pollution may be caused by the men working at that place. The deep well is protected from any pollution.

The creek from which some of the water is obtained receives considerable direct pollution, especially during the summer months, there being a large hotel and a large boarding school which discharges raw or settled sewage into the creek a short distance above the intake. The hotel accommodates about 200 people and the boarding school about 160 boys. There is also a saw mill employing about 20 people located three quarters of a mile above the intake and another hotel which accommodates about 50 people is located about one mile above the intake. There are also two or three residences on the watershed. Although the disposal of wastes for all but the first two places mentioned seems to be reasonably satisfactory, there always exists danger of accidental or intermittent contamination from the dwellings, the smaller hotel and saw mill as well.

Above the lower spring and near the railroad tracks is a small brook. The water of this brook disappears into the ground but it is probable that some of the flow comes out at the spring. This brook may receive a small amount of pollution from passing trains and from the men working near by at the bottling works.

At the time of the inspection samples of the water were obtained from a tap in the village, from the main spring, from the secondary spring and from the intake at the brook, the results of the analyses of which will be found in the appended table.

From these analyses it will be seen that the main supply which was obtained principally from the main spring was clear, had practically no odor and was very soft. The figures for nitrogen in its various forms were low with the exception of that for nitrates which was somewhat high. The oxygen consumed and chlorine tests were also high. The bacterial count was moderate and the sample contained no organisms of the B. coli group. This water on the whole was satisfactory from a sanitary standpoint due principally, it is believed and judging from the sanitary conditions surrounding the other source, to the fact that the water was being obtained chiefly from the spring and that it was receiving considerable storage at the time of the inspection.

The analyses of the upper or main spring gave a very low count of bacteria although organisms of the B. coli group were found in one of the 10 c. c. samples. This showed a comparatively good water when considered from a sanitary standpoint.

The analyses of the water from the secondary spring gave results practically the same as those for the main spring although the total number of bacteria was somewhat greater and B. coli were also found in 10 c. c. samples. This higher count was probably due to a small amount of pollution which was probably received from the vicinity of the railroad.

The sample of the water taken at the upper intake of the brook contained

many bacteria and those of the B. coli group were found in 1 c. c. samples. Since the sample was taken after the hotels and boarding school had closed for the year, the results although showing considerable pollution, did not show the effect of the pollution that would prevail during the summer months while the hotels and school were open.

As a result of this investigation and the analyses, the following conclusions may be drawn:

1. That at the time of the inspection the main water supply of Pine Hill was in general of a satisfactory sanitary quality.
2. That the supply from the secondary spring would probably be of a satisfactory quality if the spring was properly protected from contamination. The spring is at present uncovered, on the side of the road and is subject to some pollution on this account as well as possible pollution from the railroad tracks and from the shipping station of the nearby bottling works.
3. That the supply from the brook is unsafe for use as a source of public water supply due to the several sources of pollution, this conclusion being confirmed by the unsatisfactory analytical results.
4. That during the summer when the hotels and the school on the watershed are open, the brook undoubtedly received a greater amount of pollution than it was receiving at the time of the inspection.
5. That since the driven well has never been used no information is available as to the amount it will yield nor as to the sanitary quality of the water. However, from a consideration of the method of development of the well and its surroundings it seems probable that it would yield a water of satisfactory sanitary quality.

In view of the above conclusions the following recommendations may be made:

1. That the brook be abandoned as an auxiliary supply on account of the pollution it receives from the hotels and the boarding school, this pollution constituting a menace to the quality of the entire supply.
2. That the secondary spring be developed and the auxiliary reservoir constructed at a higher elevation, suitably protected from pollution in order that both springs may be used for the entire system at the same time.
3. That sanitary conveniences be provided at the shipping station of the employees in order to prevent fecal contamination of the ground in the vicinity of the secondary spring and watershed above.
4. That the pump at the well be placed and maintained in a proper operating condition so that it may be used in case the supply from the spring is insufficient.
5. In case these three sources are insufficient then additional springs should be developed in localities free from pollution.

Respectfully submitted,

THEODORE HORTON,
Chief Engineer

ALBANY, N. Y., *November* 23, 1915

most of the houses and also for the railroad station, which is 500 feet east. There is a population of about 10 within a radius of 500 feet from the wells. Between 500 and 1,000 feet of the wells there are about 5 houses with a total population of 25 people. There are no sanitary conveniences at the pumping station and it is probable that some pollution is caused at times by those working at the pumping station.

At certain times the ground water available from both springs and wells is insufficient, and it is proposed to take water from Stissing pond and use the same after filtration. This pond has an area of about .15 square miles and at places is quite deep, while at other places, especially the lower end, where the water is very shallow, several acres are covered with cattails. The watershed tributary to the pond is about 1.85 square miles. There are two boat houses on the lake and 4 or 5 houses on the shore of the lake and about 10 houses on the watershed.

There are said to be several springs discharging directly into the lake. It is proposed to place the intake pipe at one of the springs and pump the water to a filter located on the bank of the pond. This filter is to be a covered concrete trough, 12 feet long, 4 feet wide and 3 feet deep, and filled with sand. The water is to pass through the sand from one end of the trough to the other after which it will be pumped to the mains and reservoir.

This proposed filter is not designed according to current practice and it is doubtful if it would be satisfactory either from a sanitary standpoint or as to the amount of water that would pass through it without passing over the top of the sand.

At the time of the inspection samples of water were collected from a tap in the village and of water from the wells after the pumps had been operating for 20 minutes, and a sample of the water from Stissing pond was obtained, and the results of these analyses are shown in the appended table.

From the analyses of the village water collected at a tap in the village, which was largely spring water, it will be seen that this supply is clear, practically free from color and moderately soft. The various tests for nitrogen show some pollution, principally in the partially oxidized state. The chlorine is somewhat higher than the normal for the vicinity. Although the bacterial count is moderate, organisms of the B. coli type were found in 1 c. c. samples. These tests all indicate the presence of some pollution, which was probably largely due to the well water which was pumped into the system and reservoir on the day previous to the inspection.

The well water was practically clear and moderately hard. The various tests for nitrogen and chlorine showed considerable pollution, as did also the total bacterial count and the presence of B. coli in samples as small as 1/10 c. c.

The samples of water from Stissing pond gave a high bacterial count and those of the B. coli type were found in 1 c. c. samples. This showed active pollution in the water, which was apparently due to the boathouses and cottages on the lake.

As a result of this investigation and of the analyses, the following conclusions may be drawn:

1. That the water taken from the springs supply was at the time of the inspection of a satisfactory sanitary and physical quality.
2. That the water from the well supply, on account of the numerous sources of contamination found to exist in this vicinity at the time of the investigation and the evidence presented by the analyses, is in its present state unsuitable for potable purposes and should not be used as a water supply unless properly sterilized by liquid chlorine or other equally satisfactory method.
3. That the contamination of the village supply indicated by the analyses of samples collected on the day of the inspection was undoubtedly largely due to the contaminated water pumped from the well supply on the previous day.
4. That the water supply derived from Stissing pond receives contamination from direct and indirect sources arising from the cottages and boathouses located along the shores of the pond and incidental or wilful contamination due to boating, fishing and bathing in the pond.

POLAND

HERMANN M. BIGGS, M.D., *State Commissioner of Health:*

A reinspection of the public water supply of Poland was made on October 20, 1915, by Dr. J. E. Clark, sanitary supervisor of District " E ". A previous investigation of this supply was made in 1911 by the Engineering Division, a full report of which will be found on page 753 of the thirty-second annual report of this Department.

The water supply of Poland is derived from springs located near the top of a hill about one mile southwest of the village. The water from these springs flows through numerous natural channels into a small brook which in turn flows into an impounding and distributing reservoir. From this reservoir the water is distributed by gravity to the village. The water works are owned and operated by the municipality. The description of the reservoir, springs and water works system in general remains practically the same as given in detail in the earlier report.

The earlier report pointed out the possibility of a certain amount of animal contamination due to the cultivation of farm lands in the vicinity, and it was recommended:

> 2. That, while without a careful survey of the immediate locality it is not possible to indicate the most efficient and economical method of diverting from the water supply the undesirable drainage, it would seem from a somewhat cursory examination of the ground that it might be best remedied by acquiring from the adjoining property the low ground, previously referred to, to a sufficient distance up the hill to make possible the extension of the present southerly ditch on a proper grade to intercept all drainage coming to this point. To do this would seem more economical than the other alternative of laying a pipe drain from the low spot through or along the edge of the reservoir so as to discharge below the dam.
>
> 3. That regular and frequent inspections be made of all parts of the works by the water board.
>
> 4. That should any difficulty be experienced by the water board in preventing any careless, wilful or unnecessary pollution of the water supply that they apply to this Department for the enactment of rules and regulations for the sanitary protection of the public water supply of the village.

From the report of Dr. Clark it appears that the water supply is now quite well protected from this pollution.

At the time of his inspection Dr. Clark collected samples of water and the results of the analyses of these samples together with others made in the past by the Division of Laboratories and Research will be found in the appended table.

These results show a water slightly colored, turbid and hard. The figures for free and albuminoid ammonia are moderately high, indicating a small amount of organic contamination. The total bacterial counts are also high, and the fecal organisms of the B. coli type indicate active contamination of animal or human origin. In view of the conditions upon the watershed it seems probable that this contamination is, however, of animal rather than of human origin. In view of the above facts, the following conclusions may be drawn:

> 1. The village authorities of Poland have apparently carried out the recommendations of this Department.
>
> 2. That the analytical results indicate, however, that a certain amount of contamination, probably of animal origin is still reaching the supply.

I would, therefore, recommend:

> 1. That the village authorities carefully inspect the surroundings of the springs and reservoirs to determine the exact sources of this contamination.

2. That the village authorities take immediate steps to prevent such contamination by the construction of more adequate drainage ditches or by other effective means.

Respectfully submitted,
THEODORE HORTON,
Chief Engineer

ALBANY, N. Y., *December* 15, 1915

REPORT OF WATER ANALYSIS FOR POLAND

Source	Tap public supply	Tap public supply	Tap public supply	Tap public supply	Tap public supply
Collected on	2/15/12	4/23/12	10/29/12	12/10/12	1/16/13
Color	5	Trace	Trace	5	5
Turbidity	Clear	Clear	Clear	Clear	Clear
Solids, total	149	184	200	160	158
Mineral residue	135	154	168	140	....
Ammonia, free	.012	.008	.008	.012	.018
Ammonia, albuminoid	.024	.020	.050	.070	.022
Nitrites	Trace	.001	.001	Trace	.005
Nitrates	3.60	2.40	3.20	1.40	3.40
Oxygen consumed	0.80	0.70	0.80	1.10	2.30
Chlorine	4.00	3.75	4.25	3.59	4.00
Hardness, total	131	129	134	117	131
Alkalinity	131	114	132	115	127
Bacteria per c.c.	190	325	425	10	275
B. coli type 10 c.c.	+	—	+	—	+
B. coli type 1 c.c.	+	—	+	—	—
B. coli type 1/10 c.c.	—	—	—	—	—

Results are expressed in parts per million. + Present. — Absent.
Abbreviations used to describe odors of water: 0, none; 1, very faint; 2, faint; 3, distinct; 4, decided; 5, strong; 6, very strong; a, aromatic; d, disagreeable; e, earthy; f, fishy; g, grassy; m, musty; v, vegetable.

REPORT OF WATER ANALYSIS FOR POLAND — *Concluded*

Source	Tap public supply	Tap public supply	Tap public supply	Tap public supply	Tap public supply	Reservoir
Collected on	2/21/13	4/3/13	5/15/13	5/20/14	10/20/15	10/20/15
Color	3	12	5	Trace	....	8
Odor, hot	....	....	....	1 a.	....	....
Odor, cold	....	....	....	1 a.	....	....
Turbidity	Clear	5	Clear	2	....	5
Solids, total	180	148	145	158	....	102
Loss on ignition	....	....	....	15	....	17
Mineral residue	....	....	....	43	....	85
Ammonia, free	.034	.018	.006	.002	....	.012
Ammonia, albuminoid	.072	.050	.038	.006	....	.060
Nitrites	.006	.001	.002	.001	....	.001
Nitrates	2.40	1.60	1.40	1.40	....	0.02
Oxygen consumed	1.00	1.60	1.20	0.90	....	6.70
Chlorine	3.75	3.00	2.75	3.25	....	2.75
Hardness, total	140	103	97	126	....	76
Alkalinity	132	101	93	118	....	72
Bacteria per c.c.	190	550	160	200	1,300	300
B. coli type 10 c.c.	—	—	+	+	3+0—	3+0—
B. coli type 1 c.c.	—	—	—	+	3+0—	0+3—
B. coli type 1/10 c.c.	—	—	—	+	1+2—	0+3—

Results are expressed in parts per million. + Present. — Absent.
Abbreviations used to describe odors of water: 0, none; 1, very faint; 2, faint; 3, distinct; 4, decided; 5, strong; 6, very strong; a, aromatic; d, disagreeable; e, earthy; f, fishy; g, grassy; m, musty; v, vegetable.

PORT BYRON

HERMANN M. BIGGS, M.D., *State Commissioner of Health:*

An investigation of the public water supply of the village of Port Byron was made on June 28, 1915, by Mr. Morton F. Sanborn, assistant engineer. The inspector was assisted at the time of inspection by Dr. F. W. Sears, sanitary supervisor, Dr. W. B. Gilbert, health officer of the village and Mr. W. L. Miller, president of the board of trustees.

Port Byron is an incorporated village, located on Owasco outlet about 7 miles north of the city of Auburn and 21 miles west of the city of Syracuse. The population of the village was 1,115 as shown by the recent census, while the 1910 census gave a population of 1,085.

Port Byron has a dual water supply. The supply for drinking and culinary purposes is obtained chiefly from privately owned wells which are located throughout the village. The village supply, which is supposed to be used only for fire protection, street and lawn sprinkling and flushing of water closets, is obtained from Owasco outlet.

This village supply is owned by the municipality and is under control of the board of trustees. The water is pumped from the outlet directly into the distributing system and reservoir. There are about 22 miles of water mains ranging from 4 to 6 inches in diameter. The municipal supply was designed and constructed by the village board about forty years ago and has been in use since that time with comparatively few changes. About 675 people, or 60 per cent. of the total population are served by this municipal supply.

The approximate daily consumption is about 47,500 gallons which corresponds to a daily per capita consumption of about 70 gallons. It is estimated that there are about 220 houses in the village and of these 135 are served by the municipal supply. Of these, 92 have inside fixtures while the remaining 43 have simply a hydrant in the yard. Of the 92 having inside fixtures, 18 have hydraulic rams which pump well water into the house; and probably in many of the remaining 74 houses the village water is used for bathing purposes and possibly for cooking or drinking.

The sewage of the village is discharged into various cesspools which are usually located in the rear of the houses.

The village is located on both sides of the creek which divides the village into two nearly equal parts. The ground on both sides of the creek has a fairly steep slope toward the creek.

In the southern part of the village a dam has been constructed on Owasco outlet to utilize the water power available. The intake for the water supply passes through the dam near the western end and projects about eight feet. The end of the intake pipe is in front of the entrance to the race way leading to the pumping station and is about 3 feet under water. A screen has been placed around the end of the pipe in order that coarse material carried in the water may be prevented from entering the pipe.

The pumping station is located on the down stream side of the dam and near the west end. This station was originally a power plant and is constructed of wood. The building and water privileges were purchased by the village and the building has been converted into a pumping station. A Rumsey triplex pump which has 7¼-inch diameter cylinders and a 10-inch stroke, is used to pump the creek water to the distributing system. The pump is operated by a turbine which is driven by water power obtained from the outlet. There is a 12 horsepower auxiliary gasoline engine for use in case the flow of water in the creek is not sufficient to operate the turbine. The pump is operated about eight hours a day at a rate of 23 revolutions per minute. The static head pumped against is about 70 pounds. The total head pumped against could not be determined since there was no water gauge at the station. The average pressure in the village is about 60 pounds.

An engineer is employed at the pumping station to operate the pump and he makes occasional visits to the reservoir to see that it is kept nearly full of

water. He spends only part of his time at the station as his work consists chiefly of keeping the plant in proper shape and of starting and stopping the pump as required to maintain the water at the proper elevation.

The reservoir which is located on the hill in the western part of the village is about 60 feet by 125 feet in plan and about 12 feet deep. The reservoir has a capacity of about 466,000 gallons which is equivalent to about 10 days consumption. It is an open earth reservoir and the inside slopes have been partially covered with riprap. The reservoir has never been cleaned. The water was quite turbid and contained hundreds of tadpoles, most of which were about ready to assume the form of the frog. Ice is cut from the reservoir and is used for cooling purposes at one of the local markets.

The Owasco outlet has a watershed of about 220 square miles. There is a total population of approximately 44,000 on this watershed which gives a population per square mile of about 200. Of this total population about 35,000 are located in the city of Auburn about seven miles above Port Byron. From Owasco Lake to Port Byron, a distance of about eleven miles, the outlet has a fall of approximately 300 feet. The drainage area consists largely of a gravel soil which overlays shale, limestone and sandstone. The average flow of water in the outlet as recorded at Auburn varies from about 700 cubic feet per second for the spring months to 70 cubic feet per second for the late summer and early fall months.

Located five miles above Port Byron is the small incorporated village of Throopsville of about 160 people. At this village there are located two grist mills and an iron products mill. The outlet probably receives a small amount of pollution at this point. The city of Auburn, seven miles above Port Byron, discharges about 80 per cent. of its sewage directly into the outlet, thereby bringing about serious pollution of the water. The discharge of this large amount of sewage into the outlet at such a comparatively short distance above the Port Byron water works intake renders this supply extremely dangerous for domestic purposes.

The mill pond from which the water is obtained was full of sediment and sludge at the time of the inspection. Considerable scum was also seen floating in the water and the sludge deposited on the bed of the pond was in an extremely putrefactive condition as evidenced by the large number of gas bubbles rising to the surface. The larger part of the pond has become filled with this sludge and sediment, and on this filled portion, cat-tails and flag have grown.

The water used for drinking in the village is obtained chiefly from local wells and about half of the houses have wells, while the people in the remaining houses obtain their supply from neighboring wells. Nearly all the houses have cesspools in the yards into which the sewage is discharged. The soil of the village is largely a course sandy gravel and it is very probable that the drainage from many of the cesspools finds its way into the wells, especially those which are located at elevations lower than the cesspools. Tests made of some of the wells in previous years show marked evidence of pollution and it is quite likely that the majority of the wells are unsafe for use as drinking water. The village water was found in the railroad station and hotels and is used for washing and bathing, although no drinking cups were noticed near the faucets.

At the time of the inspection of this supply a sample of the village water was obtained from a tap at the pumping station and the analyses of this sample together with analyses previously made by the Division of Laboratories and Research will be found in the appended table

It is evident from the recent as well as previous analyses that the village water is unsafe for use for drinking, bathing or culinary purposes. The water is hard and usually colored and turbid. The chemical analyses show considerable amounts of undecomposed and decomposing organic matter and the high bacterial counts together with the constant occurrence of organisms of the B. coli type in samples as small as 1/10 c. c. indicate the gross pollution of the water by fecal matter.

As a result of this investigation and of the analyses the following conclusions may be drawn:

1. That the public water supply of Port Byron is grossly polluted by the sewage of the city of Auburn and consequently is totally unfit for a public supply.
2. That the various wells throughout the village which supply the inhabitants with drinking water are undoubtedly subject to serious contamination due to their location in a thickly settled community where the subsurface water is polluted by the leachings from numerous cesspools.

In view of the above conclusions, I would recommend that the village authorities take immediate steps to secure a new supply, ample in quantity and of a satisfactory, sanitary and esthetic quality. Before acting upon this recommendation the village should retain the services of a competent sanitary engineer to advise in respect to the best and most economical method of securing a safe and wholesome public water supply.

Respectfully submitted,

THEODORE HORTON,
Chief Engineer

ALBANY, N. Y., *August* 5, 1915

RESULTS OF WATER ANALYSES

Abbreviations used to describe odors of water: 0, none; 1, very faint; 2, faint; 3, distinct; 4, decided; 5, strong; 6, very strong; a, aromatic, d, disagreeable; e, earthy; f, fishy; g, grassy; m, musty; v, vegetable

Municipality	County	Source of ample	Date of collection	Physical				Chemical (Parts Per Million)											Bacteriological			
						Odor		Solids		Nitrogen as—							Hardness			B. Coli Type + = present − = absent		
				Color	Turbidity	Cold	Hot	Total	Loss on ignition	Mineral residue	Free ammonia	Albuminoid ammonia	Nitrites	Nitrates	Oxygen consumed	Chlorine	Total	Alkalinity	Bacteria per c.c.; gelatin 20°, 48 hours	10 c.c.	1 c.c.	1-10 c.c.
[redacted]																						
Port Byron*	Cayuga	Tap, public supply	12/15/15	3	5	....	....	243	....	....	.854	.168	.025	0.90	2.50	6.87	165.8	160.0	280,000	+	+	+
Port Byron	Cayuga	Tap, public supply	3/ 2/09	2	4	....	....	152	....	125	.042	.158	.005	0.80	2.00	2.50	110.0	101.5	9,800	+	+	+
Port Byron	Cayuga	Tap, public supply	3/16/10	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	35,000	....	....	....
Port Byron	Cayuga	Tap, public supply	4/18/10	20	5	....	....	210	....	190	.130	.194	.025	0.32	3.70	3.75	140.0	110.0	4,000	+	+	+
Port Byron	Cayuga	Tap, public supply	5/ 3/10	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	51,800	+	+	....
Port Byron	Cayuga	Tap, public supply	11/ 7/10	5	3	....	....	260	....	192	.134	.118	.032	1.20	1.30	6.25	128.6	119.0	275,000	+	+	+
Port Byron	Cayuga	Tap, public supply	3/25/12	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	4,500	−	−	−
Port Byron	Cayuga	Tap, public supply	4/26/12	10	5	....	....	163	....	134	.004	.086	.003	0.60	2.00	2.00	108.6	100.0	1,500	+	+	+
Port Byron	Cayuga	Tap, public supply	6/28/15	5	5	4 v.	4 v.	255	70	185	.244	.114	0.10	1.20	4.00	5.75	131.4	121.0	5,400	+	+	+
[redacted]																						

* Municipal supply.

PORT JEFFERSON

HERMANN M. BIGGS, M.D., *State Commissioner of Health:*

An investigation of the public water supply of Port Jefferson, L. I., was made on September 29, 1915, by Mr. C. M. Baker, assistant engineer, accompanied by Dr. Frank Overton, sanitary supervisor of District "S."

Port Jefferson is an unincorporated village in the town of Brookhaven, Suffolk county, on the Wading River branch of the Long Island railroad, about 59 miles from New York city. The resident population of the village is about 2,800, but during the summer this increases to approximately 3,500.

The water supply is owned and controlled by the Port Jefferson Water Company and consists of 4 driven wells and a pumping plant located near the harbor in the lower part of the village. From these wells water is pumped to a concrete reservoir, supplying the lower portion of the village, and to a standpipe, which supplies the upper part of the village. About 60 per cent. of the population is served with the water. There is a total of some 400 service taps, 10 per cent. of which are metered. The water consumption during the summer averages 180,000 to 200,000 gallons daily and during the winter about 150,000 gallons daily. The maximum daily consumption at any one time has been approximately 350,000 gallons. The gravity pressure in the lower part of the village, from the concrete reservoir, is about 100 pounds per square inch, but at times, when water is being pumped into the standpipe supplying the upper level, the pressure in the mains of the lower level near the harbor is increased to about 150 pounds per square inch. About three-quarters of the water used is supplied from the concrete reservoir.

The wells from which the supply is derived are about 60 feet deep and pass through the following strata: From the surface to a depth of 5 feet below the surface, loam; 5 to 51 feet, sand and gravel; 51 to 54 feet, hardpan. Water is drawn from a water-bearing gravel strata just below the hardpan. Pumping tests on the two wells first constructed showed a yield of approximately 8,000 gallons each per hour. Water is pumped from the wells by two Worthington pumps, one with a capacity of 20,000 gallons and the other 15,000 gallons per hour and forced to the reservoir and standpipe. The source of power is steam, which is also used to generate electricity for an electric lighting plant, operated in connection with the pumping plant.

The concrete reservoir is located on a hill in the eastern part of the village and has a capacity of approximately 250,000 gallons. The standpipe is located near the railroad station, in the southeastern portion of the village and has a capacity of approximately 132,000 gallons. The water is conveyed to the consumers by about 8 miles of mains ranging from 4 to 10 inches in diameter.

The wells and pumping plant are located between West Broadway and the harbor near a small creek which flows through the village and discharges into the harbor. The population within 500 feet of the plant is about 25 or 30 people, and beyond this distance and within 1,000 feet of the plant there are probably 200 inhabitants. One privy, provided with no vault and in a very insanitary condition, is located approximately 25 feet from one of the wells and another privy, in a similar condition, about 150 feet distant. A stable and pigpen are located just across the street from the plant. The stream, which passes through the village and discharges into the harbor about 200 feet from the plant, receives sewage from a considerable portion of the village, and, in fact, the insanitary conditions regarding sewerage in this village have been the subject of severe criticism for some time. Open sewers or drains receive sewage from many toilets and also direct drainage from many insanitary privies and discharge into the creek. The main part of the village lies at a greater elevation and to the southeast of the plant and consequently the insanitary conditions regarding sewerage previously described undoubtedly cause considerable pollution of the ground water and, since the hardpan stratum through which the wells pass is probably of only limited area, it is possible that this polluted ground water under certain conditions may find its way into the supply.

Samples of the water were collected by Dr. Frank Overton, sanitary supervisor, on October 23 and sent to the Division of Laboratories and Research for analyses, the results of which are shown in the appended table.

The results of the analyses show the presence of a small amount of organic matter, a low chlorine content, a low bacterial count and the absence of bacteria of the B. coli type.

While these results indicate a water of a satisfactory sanitary quality at the time of the inspection, it is impossible to judge the character of a water under all conditions from a single analysis, and it is not difficult to conceive that at another time, due to seasonal variation of the ground water flow, the water may become contaminated from the influence of the pronounced insanitary condition now existing in the village. Pollution may under certain conditions find its way around or through breaks in the hardpan stratum which overlies the source of supply. Other wells in the village may act as channels through which pollution may enter the stratum from which the supply is derived, and a variation in the ground water flow may bring about, under certain conditions, pollution of the wells from which the water supply is derived.

As a result of this investigation, it may be concluded that, although the analytical results of the water collected from the Port Jefferson public water supply at the time of the inspection showed no active contamination, numerous insanitary conditions exist near the wells and in the village which may at times affect the sanitary quality of the water supply.

Too much emphasis cannot be placed upon the fact that every effort should be made by the water company and village authorities to protect the water supply from all sources of pollution. Furthermore, the insanitary sewerage conditions in the village are a menace not only to the water supply but also to the general health of the community. Therefore I beg to offer the following recommendations, to be acted upon by the water company in conjunction with the village officials:

1. That all privies and cesspools within 500 feet of the wells be made impervious or provided with watertight containers and that the contents be removed from them and disposed of in some remote place in a sanitary manner at proper intervals.
2. That the general practice in the village of discharging sewage into open drains be discontinued and that some satisfactory method of disposal be provided, preferably by the construction of an adequate system of sewerage and sewage disposal.
3. That analyses of the water be made occasionally during the year to detect the presence of any active contamination which may occur.
4. That should such contamination at any time be found present,
   (a) the source of pollution be determined and eliminated or
   (b) if such steps appear to be impossible or impracticable, the supply be sterilized by liquid chlorine or other equivalent method.

Respectfully submitted,

THEODORE HORTON,
Chief Engineer

ALBANY, N. Y., *November* 12, 1915

REPORT OF WATER ANALYSIS FOR PORT JEFFERSON

Source		Tap at pumping station	Tap in village
Collected on		9/29/15	....
Color		Trace	....
Odor, hot		1 v.	....
Odor, cold		1 v.	....
Turbidity		Clear	....
Solids, total		40	....
Loss on ignition		8	....
Mineral residue		32	....
Ammonia, free		.006	....
Ammonia, albuminoid		.004	....
Nitrites		.001	....
Nitrates		.020	....
Oxygen consumed		2.80	....
Chlorine		4.75	....
Hardness, total		15.60	....
Alkalinity		14.00	....
Bacteria per c.c.		6	10
B. coli type	10 c.c.	0+3—	0+3—
	1 c.c.	0+3—	0+3—
	1/10 c.c.	0+3—	0+3—

Results are expressed in parts per million. + Present. — Absent.
Abbreviations used to describe odors of water: 0, none; 1, very faint; 2, faint; 3, distinct; 4, decided; 5, strong; 6, very strong; a, aromatic; d, disagreeable; e, earthy; f, fishy; g, grassy; m, musty; v, vegetable.

PORT JERVIS

HERMANN M. BIGGS, M.D., *State Commissioner of Health:*

A reinspection of the public water supply of Port Jervis was made on September 1, 1915, by Dr. C. W. Berry, sanitary supervisor of District "N." Previous investigations of this supply were made by the Engineering Division in 1908 and 1909, reports of which will be found on pages 310 and 852, volume 2, of the thirtieth annual report of this Department.

The water supply of Port Jervis is derived from a number of small streams impounded in three large reservoirs north of the city. These reservoirs are known as No. 1, No. 2 and No. 3 respectively. No. 1 serves as a distributing reservoir, while the other two are storage reservoirs. The total capacity of the three reservoirs is about 650,000,000 gallons. There are 25 miles of distribution mains ranging from 4 to 10 inches in diameter, through which the water is distributed by gravity at pressures ranging from 40 to 60 pounds per square inch. The population of Port Jervis is about 9,400, of which 90 per cent. uses the supply. The average daily consumption is nearly 3,000,000 gallons, of which 50 per cent. is used by the Erie Railroad. At times of drought the supply from the reservoir can be supplemented by pumping directly from the Neversink river. The water works are owned and operated by the Port Jervis Water Works Company.

The watershed tributary to the reservoirs is wild country, mostly wooded and hilly. This watershed is approximately 5.15 square miles in area and is owned and controlled entirely by the water company. The O'Gorman place, which formerly was a source of contamination, has been purchased and the dwellings partly dismantled. A house has been constructed for the caretaker upon land which slopes away from the reservoir. This caretaker lives here during the entire year and keeps a constant supervision over the watershed. Fishing or hunting are not allowed on the land owned by the company. Rules and regulations for the sanitary protection of this watershed were enacted by this Department in 1897.

In times past there has been trouble from tastes and odors in the supply owing to growths of algae in the reservoirs at times of low water. At the time of the reinspection, however, no growths of any kind were noticed.

The pumping station on the Neversink river was installed in 1909 and has been used at various times to supplement the regular supply. This auxiliary supply was used for four months in 1914, the longest time it has ever been necessary to obtain an additional amount of water. On the average the auxiliary supply has been used for one or two months about every other year. During the present year it has not been used at all.

The pumping station consists of a brick and concrete building located on the bank of the river. This building contains two Worthington steam pumps with a capacity of 2,000,000 gallons per day. The intake is a 14-inch iron pipe, so constructed that it can be taken apart when not in use.

The Neversink river has a watershed area of about 345 square miles. The river receives contamination from numerous small hamlets located along its banks, from the Ontario and Western Railroad, which runs closely parallel to its eastern shore, from small labor camps, picnic parties, bathers, etc. When this auxiliary supply is used the water is treated with hypochlorite of lime. The arrangement for applying the sterilizing agent is rather crude and consists of two wooden barrels, of about 40 gallons capacity each, arranged with stopcocks, so that the hypochlorite solution from these barrels drips into a basin placed beneath the barrels and thence into the intake pipe. No accurate information is available as to the rate at which the hypochlorite has been applied to the water.

The earlier reports pointed out the desirability of corrective measures for the algae growths in the reservoirs and the necessity for improving the sanitary conditions at the O'Gorman property. It was also recommended that the Neversink river water when used should be sterilized.

From the report of Dr. Berry, it appears that the water company has acted in accordance with the recommendations.

At the time of his inspection, Dr. Berry collected samples of water from the regular supply and from the Neversink river, and the results of the analyses of these samples, together with others made in the past by the Division of Laboratories and Research, will be found in the appended table.

These analyses show that water derived from the upland reservoirs is of a reasonably satisfactory sanitary and physical quality, being moderately colored, very soft, with moderately low bacterial counts, and comparatively few organisms of the B. coli type. The single analysis of the Neversink river water shows it to be contaminated by animal or human wastes, as indicated by the high bacterial count and the prevalence of fecal organisms of the B. coli type.

In view of the above facts, the following conclusions may be drawn:

1. That the Port Jervis Water Works Company has carried out the previous recommendations of this Department.
2. That the water supply derived from the upland reservoirs is of a reasonably satisfactory sanitary and physical quality, although in the past subject to trouble from algae growths.
3. That the auxiliary supply derived from the Neversink river is subject to serious contamination and, unless carefully purified at such times as it is used, may bring about an outbreak of typhoid fever in the city.

I would therefore recommend:

1. That the water works company continue to maintain their careful oversight of the sanitary conditions upon the watershed tributary to their reservoirs.
2. That, in view of the more satisfactory results obtainable by sterilization with liquid chlorine, the water company abandon the present crude hypochlorite plant and substitute suitable apparatus for sterilization of the auxiliary supply when used with liquid chlorine.

Respectfully submitted,

THEODORE HORTON,
Chief Engineer

ALBANY, N. Y., *December* 11, 1915

REPORT OF WATER ANALYSIS FOR PORT JERVIS

Source	Tap public supply	Tap public supply	Tap public supply	Tap public supply	Tap public supply
Collected on	10/19/10	1/14/11	3/30/11	5/17/11	10/28/11
Color	15	10	20	15	15
Turbidity	Trace	Trace	2	10	Trace
Solids, total	46	24	35	36	39
Loss on ignition	22	11	14	11	18
Mineral residue	24	13	21	25	21
Ammonia, free	.008	.024	.012	.008	.014
Ammonia, albuminoid	.080	.148	.058	.084	.078
Nitrites	.001	.002	.001	.001	.001
Nitrates	0.10	0.04	Trace	0.04	Trace
Oxygen consumed	3.70	5.70	3.00	1.80	2.30
Chlorine	1.50	0.50	1.50	1.00	1.00
Hardness, total	14.3	11.1	11.1	12.7	12.7
Alkalinity	13.0	6.0	8.0	3.5	5.0
Bacteria per c.c	....	270	500	120	90
B. coli type, 10 c.c.	+	+	+	+	+
B. coli type, 1 c.c.	—	+	—	—	+
B. coli type, 1/10 c.c.	—	—	—	—	—

Results are expressed in parts per million. + Present. — Absent.

Abbreviations used to describe odors of water: 0, none; 1, very faint; 2, faint; 3, distinct; 4, decided; 5, strong; 6, very strong; a, aromatic; d, disagreeable; e, earthy; f, fishy; g, grassy; m, musty; v, vegetable.

REPORT OF WATER ANALYSIS FOR PORT JERVIS

Source	Tap public supply	Tap public supply	Tap public supply	Tap public supply	Tap public supply	Tap public supply	Tap public supply
Collected on	1/26/12	4/4/12	10/9/12	11/13/12	12/30/12	1/31/13	3/13/13
Color	15	10	10	22	15	5	20
Turbidity	Clear	Trace	Trace	Trace	Trace	Trace	Clear
Solids, total	32	19	49	32	27	31	35
Loss on ignition	15	6	18	12	10	......	....
Mineral residue	17	13	31	20	17	......	....
Ammonia, free	.024	.010	.018	.028	.028	.012	.010
Ammonia, albuminoid	.074	.036	.082	.124	.082	.064	.082
Nitrites	.002	Trace	Trace	.001	Trace	.001	Trace
Nitrates	0.08	0.04	0.10	0.08	0.06	0.04	0.06
Oxygen consumed	3.60	1.50	2.50	4.10	2.60	1.40	4.30
Chlorine	2.50	0.50	1.25	1.00	1.25	1.25	0.50
Hardness, total	11.1	9.5	19.5	14.3	11.1	14.3	20.8
Alkalinity	4.0	4.0	9.0	4.0	5.0	5.0	5.0
Bacteria per c.c	900	100	275	210	800	80	15
B. coli type, 10 c.c.	+	+	+	+	—	—	—
B. coli type, 1 c.c.	—	—	—	—	—	—	—
B. coli type, 1/10 c.c.	—	—	—	—	—	—	—

Results are expressed in parts per million. + Present. — Absent.

Abbreviations used to describe odors of water: 0, none; 1, very faint; 2, faint; 3, distinct; 4, decided; 5, strong; 6, very strong; a, aromatic; d, disagreeable; e, earthy; f, fishy; g, grassy; m, musty; v, vegetable.

REPORT OF WATER ANALYSIS FOR PORT JERVIS

Source	Tap public supply	Tap public supply	Tap public supply	Tap public supply	Neversink river
Collected on	7/10/13	10/8/13	5/24/14	9/1/15	9/11/15
Color	17	25	22	8	....
Odor, hot	....	....	2 v.	2 v.	....
Odor, cold	....	....	2 v.	2 v.	....
Turbidity	Trace	Trace	2	2	....
Solids, total	25	23	36	35	....
Loss on ignition	....	....	23	10	....
Mineral residue	....	....	13	25	....
Ammonia, free	.004	.034	.022	.010	....
Ammonia, albuminoid	.084	.132	.050	.060	....
Nitrites	Trace	.001	.001	.004	....
Nitrates	0.06	0.06	0.08	0.04	....
Oxygen consumed	3.20	3.60	4.00	3.50	....
Chlorine	0.62	2.25	0.75	2.00	....
Hardness, total	9.5	14.3	11.1	19.5	....
Alkalinity	4.0	6.0	3.0	....	....
Bacteria per c.c.	....	550	1250	15	1900
B. coli type, 10 c.c.	+	+	+	1+2—	0+3—
B. coli type, 1 c.c.	+	+	—	3+0—	3+0—
B. coli type, 1/10 c.c.	—	—	—	0+3—	0+3—

Results are expressed in parts per million. + Present. — Absent.

Abbreviations used to describe odors of water: 0, none; 1, very faint; 2, faint; 3, distinct; 4, decided; 5, strong; 6, very strong; a, aromatic; d, disagreeable; e, earthy; f, fishy; g, grassy; m, musty; v, vegetable.

POTSDAM

HERMANN M. BIGGS, M.D., *State Commissioner of Health:*

A reinspection of the public water supply of Potsdam was made on July 6, 1915, by Dr. B. R. Wakeman, sanitary supervisor of District "B." A previous investigation of this supply was made by the Engineering Division in 1912, a full report of which will be found on page 730 of the thirty-third annual report of this Department.

The public water supply of Potsdam is derived from the Racquette river from a point above the upper dam opposite the central part of the village. From this intake the water is pumped through the distributing system of the village. The waterworks system remains the same as described in the earlier report.

Racquette river above the point of intake has an estimated watershed area of 1910 square miles. The population upon this watershed may be estimated at 10 per square mile. In addition to the indirect pollution from the resident population upon the watershed there is also direct sewage discharge from a population of about 1,200 to 1,500. Furthermore, considerable amounts of industrial wastes are discharged into the river above Potsdam from various paper mills. The unsatisfactory sanitary condition of the unpurified Racquette river water was clearly pointed out in the earlier report. Furthermore, the unsatisfactory quality of the village supply is so well known locally that practically none of the residents use the water for drinking purposes. The drinking water supply for the village is obtained either from private wells or from bottled spring water.

In March, 1915, the question of authorizing the expenditure of $1,500 for the investigation of sources of supply of water suitable for use in the village was submitted to the taxpayers but this measure was overwhelmingly defeated. In 1913 the Board of Water Commissioners employed sanitary engineers to make a report on a proposed new system. These engineers reported that it was possible and entirely feasible to obtain a new supply from upland streams a few miles southeast of the village at a reasonable cost. In spite of the efforts to obtain a new supply the conditions remain in the same unsatisfactory state.

At the time of the earlier report the following recommendations were made:

1. That the Board of Water Commissioners of the village of Potsdam take steps to improve the sanitary quality of the public water supply by the installation of some approved method of purifying the present Racquette river supply or by seeking and installing a new, safe and adequate source of water supply.

2. That in order that the important engineering and sanitary features may be considered in developing a new supply, or improving the present supply, and also that careful and accurate comparison can be made of the various possible plans to determine the best and most economical means of providing the village with a safe and acceptable water, the village should secure the services of a competent sanitary engineer to thoroughly investigate and advise them in this matter.

It would appear that the Board of Water Commissioners has attempted to carry out these recommendations but the full accomplishment of its purpose has been defeated by the indifference shown by the citizens of the village in this important matter.

At the time of his investigation, Dr. Wakeman collected samples of water from various points on the distribution system and the results of these analyses together with others made in the past by the Division of Laboratories and Research will be found in the appended table.

These analyses show a soft water, highly colored and at times very turbid. The total bacterial counts are usually excessive even for a surface supply and organisms of the B. coli type are found constantly in 10 c. c. (with the exception of the recent sample from the forebay), frequently in 1 c. c. and occasionally in 1/10 c. c. Such results taken in conjunction with the known insanitary conditions upon the watershed show very clearly, not only the unsatisfactory quality of the supply but its potentially dangerous character. The fact that the village has not suffered more seriously from typhoid fever in the past is probably due, however, to the fact that this water is used to little, if any extent for drinking purposes.

In view of the above facts, the following conclusions may be drawn:

1. That the Board of Water Commissioners of Potsdam have apparently made every effort to carry out the recommendations of the previous report, within their power.

2. That the failure of the efforts of the Water Commissioners have been due to the indifference with which this very serious question is viewed by the citizens of the village.

3. That the water supply of Potsdam is open to serious and dangerous contamination not only from indirect sources but from direct sewage discharge.

I would, therefore, recommend:

1. That the Board of Water Commissioners again present the question of improvements to the water supply, to the citizens for authorization towards carrying out the recommendations of this Department.

2. That, pending the installation of an adequate and modern filter plant for the Racquette river supply or the installation of a new supply from a source of unquestioned sanitary quality, the village authorities install apparatus for the sterilization of the Racquette river supply with liquid chlorine.

Respectfully submitted,

THEODORE HORTON,
Chief Engineer

ALBANY, N. Y., *August* 14, 1915

RESULTS OF WATER ANALYSES

Abbreviations used to describe odors of water: 0, none; 1, very faint; 2, faint; 3, distinct; 4, decided; 5, strong; 6, very strong; a, aromatic, d, disagreeable; e, earthy; f, fishy; g, grassy; m, musty; v, vegetable

Municipality	County	Source of sample	Date of collection	PHYSICAL				CHEMICAL (PARTS PER MILLION)											BACTERIOLOGICAL			
						ODOR		SOLIDS			NITROGEN AS—						HARDNESS			B. COLI TYPE + = PRESENT — = ABSENT		
				Color	Turbidity	Cold	Hot	Total	Loss on ignition	Mineral residue	Free ammonia	Albuminoid ammonia	Nitrites	Nitrates	Oxygen consumed	Chlorine	Total	Alkalinity	Bacteria per c.c.; gelatin 20°, 48 hours	10 c.c.	1 c.c.	1-10 c.c.
Potsdam......	St. Lawrence...	Tap, public supply..........	3/15/12	40	Tr.	....	....	69	23	46	.032	.250	.003	0.24	15.8	0.75	18.0	15.8	270	+	+	—
Potsdam......	St. Lawrence...	Tap, public supply..........	4/19/12	65	20	....	....	48	32	16	.004	.156	.001	0.14	12.6	0.50	4.0	12.6	1,100	+	—	—
Potsdam......	St. Lawrence...	Tap, public supply..........	9/ 7/12	60	Tr.	....	....	90	24	66	.008	.124	Tr.	0.08	15.6	0.75	21.0	15.6	325	+	+	+
Potsdam......	St. Lawrence...	Tap, public supply..........	10/25/12	55	3	....	....	70	30	40	.014	.166	Tr.	0.24	18.0	0.50	15.0	18.0	500	+	—	—
Potsdam......	St. Lawrence...	Tap, public supply..........	12/ 6/12	45	Tr.	....	....	53	26	27	.012	.126	.001	0.08	12.8	1.00	9.0	12.8	5,600	+	—	—
Potsdam......	St. Lawrence...	Tap, public supply..........	1/10/13	65	3	....	....	51	....	....	.016	.094	Tr.	0.14	8.8	0.50	16.9	9.0	1,000	+	+	—
Potsdam......	St. Lawrence...	Tap, public supply..........	2/14/13	45	2	....	....	40	....	....	.040	.108	Tr.	0.16	10.4	0.50	14.3	6.0	500	+	—	—
Potsdam......	St. Lawrence...	Tap, public supply..........	3/29/13	50	5	....	....	33	....	....	.020	.188	Tr.	0.14	8.4	0.25	19.5	6.0	4,500	+	+	—
Potsdam......	St. Lawrence...	Tap, public supply..........	5/ 9/13	45	2	....	....	47	....	....	.008	.132	Tr.	0.06	9.8	0.50	12.7	8.0	230	+	+	—
Potsdam......	St. Lawrence...	Tap, public supply..........	6/20/13	50	3	....	....	48	....	....	.004	.110	.001	0.06	9.2	0.25	14.3	8.0	700	+	+	—
Potsdam......	St. Lawrence...	Tap, public supply..........	7/25/13	60	2	....	....	73	....	....	.036	.142	.001	0.06	12.4	0.50	27.3	17.0	1,300	+	+	+
Potsdam......	St. Lawrence...	Tap, public supply..........	5/14/14	40	5	2 a.	2 a.	35	15	20	.010	.104	.001	0.12	11.2	0.50	14.3	5.0	180	3+0—	3+0—	0+3—
Potsdam......	St. Lawrence...	Racquette river (forebay)...	7/ 6/15	15	5	2 v.	2 v.	59	35	24	.006	.108	.001	0.20	17.6	1.00	22.1	15.0	45	0+3—	0+3—	0+3—
Potsdam......	St. Lawrence...	Discharge from pump.......	7/ 6/15	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	4,300	3+0—	3+0—	3+0—
Potsdam......	St. Lawrence...	Tap, public supply (west)...	7/ 6/15	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	1,300	3+0—	3+0—	0+3—
Potsdam......	St. Lawrence...	Tap, public supply (north)...	7/ 6/15	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	1,300	3+0—	0+3—	0+3—

POUGHKEEPSIE

HERMANN M. BIGGS, M.D., *State Commissioner of Health:*

A reinspection of the public water supply of Poughkeepsie was made Oct. 14, 1915, by Dr. L. H. Hubbard, sanitary supervisor of District "T" and the following report is based largely upon information furnished by him. A full report on a previous inspection of this supply made by Professor H. N. Ogden in connection with his investigation of the sanitary conditions in this city will be found on page 690 of the twenty-eighth annual report of this Department.

The public water supply of Poughkeepsie is obtained from the Hudson river at a point just above the city itself. The supply is treated by preliminary sterilization with hypochlorite of lime, coagulation and sedimentation, slow sand filtration, and final sterilization with liquid chlorine. The intake is a 24-inch pipe extending 222 feet into the river. Over this intake pipe a small brick house was erected in 1912 which contains two concrete tanks for the hypochlorite solution. Fifty pounds of hypochlorite are used each day and it is estimated that 15 pounds of free chlorine are added to 3,500,000 gallons of water as it passes through the intake or about 0.5 parts per million by weight. After treatment with hypochlorite, the water is pumped to a sedimentation basin constructed in 1907. This basin is 150 feet by 270 feet in plan and has a capacity of 3,000,000 gallons. Cross partitions retard the flow and the period of detention is 20 hours. The effluent from this tank flows into a small sedimentation tank and thence to the filter beds. The filtration beds consist of four units of sand filters. These units can be operated independently so that one filter may be cleaned while the other three are in operation. After passing through the filters the water is collected in a small clear water basin. At the edge of this basin the chlorination apparatus supplied by the Electro Bleaching Gas Company has been installed, which applies three pounds of chlorine gas to each million gallons of filtered water or about .35 parts per million by weight. Daily analyses are made at the laboratory of the filtration plant and submitted to the local health officer weekly.

The watershed of the Hudson river above Poughkeepsie is approximately 11,500 square miles in area and the total population on this area may be estimated at 1,200,000 or about 100 per square mile. The gross pollution of the Hudson river is well known and, in addition to the general pollution from the watershed above Poughkeepsie, the sewers of the Poughkeepsie State Hospital for the Insane discharge into the river about 2,000 feet above the intake and the sewers of Poughkeepsie itself flow into the river below the intake and under conditions of flood tide the sewage from the city will flow past the intake.

At the time of the previous report, the gross pollution of the river was pointed out and the necessity for careful operation of the filter plant emphasized. It is evident from Dr. Hubbard's report that the city authorities recognize the importance of securing adequate purification as is shown by the installation of the hypochlorite plant in 1913 and the liquid chlorine apparatus in 1914.

REPORT OF WATER ANALYSIS FOR POUGHKEEPSIE

Source	Date	Color	Turbidity	Oxygen consumed	Total hardness	Alkalinity	Bacteria per c.c.	B. coli type		
								10 c.c.	1 c.c.	.1 c.c.
Raw water	Jan. 10, 1910	28	16	9.20	67.1	57.0	8,000	+	+	+
Filtered water	Jan. 10, 1910	28	Cl.	9.20	66.4	57.0	55	−	−	−
Tap, public supply	Oct. 21, 1910	35	Cl.	9.40	72.9	68.0	10	+	−	−
Raw water	Nov. 29, 1910	40	30	15.80	71.4	58.0	5,400	+	+	+
Filtered water	Nov. 29, 1910	40	Tr.	11.96	70.0	55.0	41	+	−	−
Raw water	Jan. 4, 1911	30	10	9.10	64.3	55.0	4,400	+	+	+
Filtered water	Jan. 4, 1911	20	Tr.	7.65	62.9	55.0	55	+	−	−
Raw water	......	40	18	9.40	62.0	50.0	1,200	+	+	−
Filtered water	......	30	Cl.	9.00	61.4	53.0	16	−	−	−
Raw water	......	30	15	4.35	36.4	27.0	45,000	+	+	+
Filtered water	......	20	Cl.	3.58	28.6	21.0	46	−	−	−
Raw water	......	......	......	......	......	......	15,000	+	+	+
Filtered water	......	20	Tr.	6.00	61.4	45.0	90	+	−	−
Raw water	Sept. 8, 1911	......	......	......	......	......	20,500	+	+	+
Filtered water	Sept. 8, 1911	25	Cl.	12.00	65.7	61.0	......	......	......	......
Raw water	Oct. 19, 1911	25	15	8.40	70.0	57.0	63,000	+	+	+
Filtered water	Oct. 19, 1911	25	Cl.	6.40	74.3	50.0	261	+	−	−
Filtered water	Dec. 5, 1911	10	2	4.90	45.7	39.0	60	+	−	−
Raw water	Jan. 16, 1912	20	15	5.40	50.0	37.0	2,100	+	+	+
Filtered water	Jan. 16, 1912	......	Cl.	4.40	50.0	37.0	4	−	−	−
Tap, public supply	Feb. 20, 1912	15	Cl.	6.20	50.0	47.0	30	−	−	−
Tap, public supply	April 30, 1912	Tr.	Cl.	1.60	30.0	22.0	10	−	−	−
Tap, public supply	Aug. 27, 1912	13	Cl.	4.60	60.0	52.0	2,600	+	−	−
Tap, public supply	Oct. 15, 1912	30	Tr.	9.10	70.0	62.0	120	+	−	−
Tap, public supply	Dec. 17, 1912	20	Cl.	6.30	53.6	45.0	20	+	−	−
Tap, public supply	Jan. 21, 1913	Tr.	Cl.	1.30	45.7	25.0	53	−	−	−
Tap, public supply	Feb. 26, 1913	15	Cl.	4.20	47.1	38.0	10	−	−	−
Tap, public supply	April 8, 1913	Tr.	Cl.	2.80	45.7	26.0	50	−	−	−
Tap, public supply	May 20, 1913	15	Cl.	4.10	52.9	42.0	70	−	−	−
Tap, public supply	July 3, 1913	15	Tr.	4.10	51.4	49.0	......	−	−	−
Tap	Mar. 16, 1914	12	Cl.	6.40	77.1	47.0	50	0+3−	0+3−	0+3−
Raw water	Oct. 14, 1914	......	......	......	......	......	5,000	3+0−	3+0−	0+3−
Eff. settling basin	Oct. 14, 1914	......	......	......	......	......	1,200	3+0−	3+0−	3+0−
Tap in laboratory	Oct. 14, 1914	......	......	......	......	......	10	0+3−	0+3−	0+3−
Tap in city	Oct. 14, 1914	......	......	......	......	......	10	0+3−	0+3−	0+3−

This table shows clearly the polluted character of the raw water and the efficiency of the purification plant. It should be noticed that the results obtained previous to 1913 were somewhat inferior to those obtained in the past two years since the installation of methods for the sterilization of the supply.

The following table giving the number of typhoid cases in Poughkeepsie seems to show the beneficial effect of the improvement to the purification system.

Date	*Cases*	*Deaths*
1900	51	11
1901	63	12
1902	33	5
1903	39	11
	186	39
Average	46.5	9.8
1904	93	15
1905	78	9
1906	66	9
1907	168	30
1908	37	9
	442	72
Average	**88.5**	**14.5**

Date	*Cases*	*Deaths*
1909	33	6
1910	37	5
1911	35	4
1912	24	4
1913	17	3
	146	22
Average	29.2	4.4

In view of the above facts, it seems evident that the purification plant is accomplishing a satisfactory degree of purification and that the installation of the sterilization plant has been extremely valuable in improving the sanitary quality of the filtered water.

It, therefore, seems unnecessary at the present time to make other recommendations than that the waterworks officials continue to operate the purification plant with the same constant care and attention that they have shown in the past.

Respectfully submitted,

THEODORE HORTON,
Chief Engineer

ALBANY, N. Y., *May* 7, 1915

PRATTSBURG

HERMANN M. BIGGS, M.D., *State Commissioner of Health:*

A reinspection of the public water supply of Prattsburg was made on October 15, 1914, by Dr. J. A. Conway, sanitary supervisor of District "K" and the following report is based largely on information furnished by him. A previous investigation of this supply was made by the Engineering Division in 1910, the full report of which will be found on page 795 of the thirty-first annual report of this Department.

The water supply of this village is derived by impounding the water of the East Center creek, supplemented by springs and a deep well located upon the watershed of the creek. The development of the springs and well was carried out in 1912 subsequent to the previous inspection. The present population of the village is 680 of which about 75 per cent. are served by the public water supply. With the exception of the springs and well the water supply system remains practically the same as at the time of the previous inspection. The waterworks are owned and operated by the village.

There are three springs on the watershed which have been connected, covered and piped to a concrete basin beneath the pump house of the well supply. This pump house is near and at an elevation of about 15 feet above the reservoir on Center creek. From the bottom of the collecting basin a 4-inch iron pipe passes along the bottom of the reservoir and extends into the 8-inch supply main to the village for a distance of about 24 feet, thus leaving an opening between the 4-inch and 8-inch pipe through which water may flow from the creek reservoir when the springs are insufficient to supply the draft from the village.

Spring No. 1 is situated above the highway about one eighth of a mile from the dam. It is surrounded by a concrete box about 5 feet deep and 2½ feet by 4 feet in plan, the whole being covered with an iron door. The land adjacent to this spring is wooded and in good sanitary condition. Spring No. 2 is situated in a pasture located about one quarter of a mile above the reservoir. This spring is developed in a manner similar to that of Spring No. 1, but a pipe about 15 feet long leads to it from a pile of stones under which the main spring is probably located. At the time of the inspection cattle were pastured in the vicinity of the spring and the ground around the spring was much trampled by the cattle pastured nearby. Spring No. 3 is below the road and well protected from surface drainage.

The driven well as noted previously is located at the pump house just above the reservoir. This is a 6-inch drilled well, 160 feet deep, and is used for emergency purposes only. The pump has not been operated on this well

this past summer as the supply from the original source has been adequate. In 1913, during the excessively dry weather this well is said to have been used for a short time. The sanitary surroundings of the well are good.

The watershed tributary to the creek supply remains practically the same as at the time of the previous inspection. At that time the population was approximately 14 on the .6 of a square mile drainage area, giving a density of population of 23 per square mile. There are four houses upon the watershed, all of which are comparatively well distant from the stream and while there is no direct pollution there is some opportunity for contamination at times of heavy rainfall by surface wash from highways, pasture lands, barnyards, etc.

The previous report pointed out that there was some possibility of dangerous contamination of the supply owing to the resident population upon the watershed and that there was also a certain amount of animal pollution which injured the esthetic quality of the supply. Furthermore, it was stated that the supply as developed at that time was inadequate to provide an unfailing supply of water for even a fraction of the population of the village, thus bringing about a menace to the health of all the inhabitants at times of water shortage. It was, therefore, recommended :

1. That the Board of Water Commissioners make such changes as might be necessary to prevent direct pollution of the water supply from the sources mentioned in the report.
2. That, should any difficulty be experienced in thus abating these conditions, the Board of Water Commissioners apply to this Department for the enactment of rules and regulations for the protection of the watershed.
3. That the village take immediate steps to inquire into the most economical means of developing the present or a new system of water works with a view of providing all the inhabitants with an unfailing supply of water of good sanitary quality, and that they retain the services of an expert sanitary engineer to advise them in this matter.

From the report of Dr. Conway it appears that the village has taken certain action towards increasing the quantity of their supply and towards improving its sanitary quality although there still remain certain conditions requiring improvement.

At the time of his inspection, samples of water were collected from the reservoir and from two taps in the village and the results of the analyses of these samples made by the Division of Laboratories and Research will be found in the appended table.

The analyses of one sample taken in 1911 represents water from the creek supply, while the sample taken by Dr. Conway probably represents the present spring supply, possibly mixed with a small amount of creek water. Analysis of the present supply shows a water slightly colored, clear and comparatively hard. The total numbers of bacteria are low except in the case of the sample taken from the tap at the mill in the village and with the exception of this same sample organisms of the B. coli type were present in only one of six 10 c. c. inoculations Whether the sample collected from the mill became contaminated during collection or the contamination shown was due to intermittent contamination of the supply itself, it is impossible to state definitely. In view of the above facts, the following conclusions may be drawn:

1. That the village authorities have taken certain action towards carrying out the recommendations of this Department although no application has been made for the enactment of rules and regulations as formerly advised.
2. That the present supply derived from the three springs is probably of a reasonably satisfactory sanitary quality provided steps are taken to prevent contamination of the supply from Spring No. 2 by the cattle pastured nearby.
3. That the auxiliary supply derived from the driven well is probably of a satisfactory quality although no analyses are available to verify this conclusion.

4. That the creek supply is open to the possibility of contamination from both human and animal sources due to the resident population upon its watershed, to the pasturing of cattle, to the fertilizing of farm land and to chance visitors.

I would, therefore, recommend:

1. That the village authorities immediately take steps to protect Spring No. 2 from contamination by cattle, by fencing off an adequate area in the immediate vicinity of this spring and protecting it from surface drainage by suitable ditches.
2. That the village remove all sources of contamination upon the surface watershed which may cause direct contamination of Center creek and, in case any difficulty is experienced in carrying out such improvements, the village apply to this Department for the enactment of rules and regulations.
3. That, if it is found impracticable to remove all such sources of contamination, the village consider the sterilization of this supply by hypochlorite of lime or liquid chlorine.

Respectfully submitted,

THEODORE HORTON,
Chief Engineer

ALBANY, N. Y., *May 7, 1915*

REPORT OF WATER ANALYSIS FOR PRATTSBURG

Laboratory No				
Source	Tap, public supply	Reservoir, public supply	Tap at mill, public supply	Tap, public supply
Collected on	4/19/11	10/15/14	10/15/14	10/15/14
Color	5	....	....	5
Turbidity	3	....	....	Clear
Odor, cold	....	....	....	1 v.
Odor, hot	....	....	....	1 v.
Solids, total	58	....	....	113
Lost on ignition	25	....	....	36
Mineral residue	33	....	....	77
Ammonia, free	.006	....	....	.010
Ammonia, albuminoid	.118	....	....	.032
Nitrites	Trace	....	....	.002
Nitrates	0.60	....	....	0.70
Oxygen consumed	1.10	....	....	2.40
Chlorine	1.00	....	....	1.38
Hardness, total	26.0	....	....	70.0
Alkalinity	23.0	....	....	70.0
Bacteria per c.c	90	20	110	15
B. coli type, 10 c.c.	0+3—	0+3—	3+0—	1+2—
B. coli type, 1 c.c.	0+3—	0+3—	2+1—	0+3—
B. coli type, 1/10 c.c.	0+3—	0+3—	1+2—	0+3—

Results are expressed in parts per million. + Present. — Absent.

Abbreviations used to describe odors of water: 0, none; 1, very faint; 2, faint; 3, distinct; 4, decided; 5, strong; 6, very strong; a, aromatic; d, disagreeable; e, earthy; f, fishy; g, grassy; m, musty; v, vegetable.

QUOGUE

HERMANN M. BIGGS, M.D., *State Commissioner of Health:*

An investigation of the public water supply furnished by the Quantuck Water Works Company to the villages of Quogue, West Hampton Beach and East Quogue, L. I., was made on September 29, 1915, by Mr. C. M. Baker, assistant engineer, accompanied by Dr. Frank Overton, sanitary supervisor of District "S."

These villages are located in the town of Southampton, Suffolk county. Quogue is on the Montauk branch of the Long Island Railroad, about 75

miles from New York city. The populations of the various villages are as follows:

Quogue, resident population	500
summer	2,000
West Hampton Beach, resident	750
summer	2,000
East Quogue, resident	600
summer	1,000

The total population served by the water supply thus varies from approximately 1,850 in the winter to 5,000 during the summer months.

The plant, consisting of wells, pumping station and standpipe, is located near Quantuck creek, about 1½ miles southwest of Quogue Station. Practically all of the population are served with the water. There are between 400 and 500 service taps, none of which are metered. The average water consumption during the summer is approximately 900,000 gallons daily, with a probable maximum of 1,000,000 gallons. The winter consumption averages approximately 200,000 gallons daily. The pressure is about 33 pounds per square inch.

The wells, 11 in number, are 8 inches in diameter and are driven through sand to a depth of 40 to 45 feet. The ground water level is approximately 4 feet below the surface. The pumps consist of 4 Rumsey pumps, 3 with capacities ranging from 500 to 700 gallons per minute and one with a capacity of 1,200 gallons per minute. They are operated by four gasoline engines, 3 of which are 40 horsepower and one 18 horsepower. The suction lift is approximately 8 feet and the surface of the water in the well is lowered about 4 feet when the pumps are in operation. The standpipe is constructed of steel, is 20 feet in diameter by 100 feet high and has a capacity of approximately 235,000 gallons. Its top is protected by a 1½-inch mesh screen. From the standpipe the water is distributed by gravity to the consumers through some 32 miles of mains ranging in size from 4 to 10 inches in diameter.

The water company owns or controls about 100 acres of land surrounding the plant. There are apparently no permanent sources of pollution, the nearest house being the residence of the engineer in charge of the plant, which is located about 400 feet distant. No toilet is provided at the pumping station, the nearest being at the engineer's residence, which, the assistant engineer was informed, is used by the employees at the plant.

Samples of water were collected and sent to the Division of Laboratories and Research for analyses, the results of which are shown in the following table. The water company also has yearly analyses made of the water:

REPORT OF WATER ANALYSIS FOR QUOGUE

Source		Pumps	Tap in village
Collected on		Sept. 29	Sept. 29, 1915
Color		Trace	....
Odor, hot		1 v.	....
Odor, cold		1 v.	....
Turbidity		Clear	....
Solids, total		42	....
Loss on ignition		10	....
Mineral residue		32	....
Ammonia, free		.010	....
Ammonia, albuminoid		Trace	....
Nitrites		.002	....
Nitrates		.060	....
Oxygen consumed		1.90	....
Chlorine		6.75	....
Hardness, total		20.80	....
Alkalinity		2.00	....
Bacteria per c.c.		275	375
B. coli type	10 c.c.	0+3—	0+3—
	1 c.c.	0+3—	0+3—
	1/10 c.c.	0+3—	0+3—

Results are expressed in parts per million. + Present. — Absent.

Abbreviations used to describe odors of water: 0, none; 1, very faint; 2, faint; 3, distinct; 4, decided; 5, strong; 6, very strong; a, aromatic; d, disagreeable; e, earthy; f, fishy; g, grassy; m, musty; v, vegetable.

The results of the analyses show that the water was satisfactory in appearance at the time samples were collected and that only a small amount of organic matter was present.

While the bacterial counts of 275 and 375 were high, they were doubtless due to the delay in transit, two days elapsing from the time of collecting samples until the analyses were made. The B. coli type was not found present.

As a result of this investigation, it is apparent that the water supply furnished by the Quantuck Water Works Company to the villages of Quogue, West Hampton Beach and East Quogue was in a satisfactory condition at the time of the inspection and that, providing proper sanitary conditions are maintained at all times in the vicinty of the plant, the water supply should remain satisfactory. In this connection, however, it should be pointed out that the employees at the plant should at all times use the toilet at the engineer's residence, and that signed regulations should be made and proper precautions at all times observed, to prevent pollution of the ground in the vicinity of the wells.

Respectfully submitted,

THEODORE HORTON,
Chief Engineer

ALBANY, N. Y., *December* 28, 1915

RANDOLPH

HERMANN M. BIGGS, M.D., *State Commissioner of Health:*

A reinspection of the public water supply of Randolph was made February 1, 1915, by Dr. John J. Mahoney, sanitary supervisor of District "M." A full report of a previous investigation of this supply made by the Engineering Division in 1911 will be found on page 757 of the thirty-second annual report of this Department.

The public water supply of Randolph is derived from two reservoirs located about two miles southeast of the village, which impound the waters from several springs, five flowing wells and a small intermittent surface stream. The water works system in general and the methods of collecting and distributing the water from the various sources remain practically the same as described in detail in the previous report. The water works are owned and operated by the village.

The two reservoirs are known locally as the old and new reservoirs respectively. The new reservoir impounds the water of a small surface stream, while the old reservoir receives water from the wells and springs and also from the stream through a gravel-covered intake in the bed of the brook. The watershed of this stream is a narrow valley, comparatively small in area, wooded and, with the exception of one house, uninhabited. At times of heavy rainfall the stream becomes very turbid and this turbidity is carried through the intake into the old reservoir, thereby causing marked turbidity in the village supply.

The earlier report pointed out that, with the exception of this undesirable turbidity, the water supply was of reasonably satisfactory sanitary quality, and it was therefore recommended:

1. That the board of water commissioners be advised to exclude the surface water in the stream, when running, from the old reservoir and to protect the water from the springs in the stream bed by some facilities which would eliminate all surface wash; and, further, that all water from the new reservoir be excluded from the old reservoir and from the village main for such time as might be necessary to clarify such water during and after a storm or thaw.

2. That the board of water commissioners of the village of Randolph be advised:

(a) That they make a thorough inspection of the farms on the watershed or the reservoirs and take necessary steps to prevent any possible direct contamination of the streams reaching their supply.

(b) That if any difficulty should be experienced in carrying out recommendations, they apply to the State Commissioner of Health for the enactment of rules and regulations to protect from contamination the waters furnishing said water supply.

(c) That in case such rules and regulations be applied for and enacted they be strenuously enforced and a systematic and regular supervision of the watershed be maintained.

From the report of Dr. Mahoney it appears that, with the exception of the inspection of the watersheds every month, none of the above recommendations have been acted upon by the village authorities.

At the time of his inspection, Dr. Mahoney collected samples of water from a tap in the village and also from one of the flowing wells. The results of the analyses of these samples, together with others made in the past by the Division of Laboratories and Research, will be found in the appended table.

These analyses show a hard water, at times highly colored and turbid, due probably to the effect of turbid surface water reaching the old reservoir from the stream. The total numbers of bacteria are as a rule very high and organisms of the B. coli type are usually present in 10 c. c., occasionally in 1 c. c., and even in 0.1 c. c. This indicates active contamination of animal or human origin. The single analysis of one of the flowing wells shows a water of satisfactory sanitary quality. It may therefore be assumed, in view of the immediate surroundings, that these wells and springs if properly protected from surface wash would afford a water of a reasonably good quality.

In view of the above facts, the following conclusions may be drawn:

1. That practically none of the recommendations of this Department have been carried out.

2. That the various springs and wells connected with the water works system, if properly developed, would afford a supply of satisfactory sanitary and esthetic quality.

3. That the surface supply should be used only in case of emergency and should be protected from any direct or indirect contamination.

I would therefore recommend:

1. That the village authorities disconnect the brook intake from the old reservoir.

2. That the new reservoir, impounding surface water, be used for emergency only.

3. That the springs and wells be used as a regular source of supply and that these springs and wells be protected by adequate ditches and developed in such manner that surface water cannot intermingle with the spring water either in the springs or in the reservoir.

4. That, in case the ground water supplies be found inadequate, the village consider the development of another supply, satisfactory in quality and quantity.

Respectfully submitted,

THEODORE HORTON,
Chief Engineer

ALBANY, N. Y., *June* 3, 1915

RESULTS OF WATER ANALYSES

Abbreviations used to describe odors of water: 0, none; 1, very faint; 2, faint; 3, distinct; 4, decided; 5, strong; 6, very strong; a, aromatic, d, disagreeable; e, earthy; f, fishy; g, grassy; m, musty; v, vegetable

				Physical				Chemical (Parts Per Million)											Bacteriological			
						Odor		Solids			Nitrogen as—						Hardness			B. Coli Type + = present − = absent		
Municipality	County	Source of sample	Date of collection	Color	Turbidity	Cold	Hot	Total	Loss on ignition	Mineral residue	Free ammonia	Albuminoid ammonia	Nitrites	Nitrates	Oxygen consumed	Chlorine	Total	Alkalinity	Bacteria per c.c.; gelatin 20°, 48 hours	10 c.c.	1 c.c.	1-10 c.c.
Randolph	Cattaraugus	Tap, public supply	1/22/09	7	2	....	....	90	21	69	.020	.222	.002	0.70	2.35	1.50	54.3	40.0	5,100	+	+	+
Randolph	Cattaraugus	Tap, public supply	3/22/10	10	Tr.	....	....	52	22	30	.014	.050	.001	0.40	3.30	0.50	26.0	25.0	700	+	−	−
Randolph	Cattaraugus	Tap, public supply	10/10/10	30	5	....	....	84	46	38	.006	.228	Tr.	0.20	9.40	0.50	37.7	34.0	52,000	+	+	+
Randolph	Cattaraugus	Tap, public supply	12/14/10	Tr.	2	....	....	120	32	88	.008	.014	.001	0.30	1.00	0.75	87.1	87.0	140	+	−	−
Randolph	Cattaraugus	Tap, public supply	1/30/11	Tr.	Cl.	....	....	108	10	98	.014	.020	.003	0.40	1.10	1.25	92.9	90.0	450	+	−	−
Randolph	Cattaraugus	Tap, public supply	4/18/11	Tr.	Cl.	....	....	101	17	84	.020	.088	.001	0.24	0.50	1.50	80.0	62.0	80	+	−	−
Randolph	Cattaraugus	Tap, public supply	11/ 4/11	5	Cl.	....	....	121	17	104	.008	.020	.001	0.20	1.40	1.37	81.4	82.0	950	+	−	−
Randolph	Cattaraugus	Tap, public supply	12/ 9/11	5	Cl.	....	....	134	14	120	.018	.044	.002	0.30	0.60	1.12	108.6	91.0	325	−	−	−
Randolph	Cattaraugus	Tap, public supply	4/ 5/12	Tr.	Cl.	....	....	92	12	80	.004	.012	Tr.	0.24	0.20	1.00	80.0	78.0	475	−	−	−
Randolph	Cattaraugus	Tap, public supply	9/23/12	Tr.	Cl.	....	....	148	27	121	.004	.014	.001	0.26	0.50	1.50	108.6	91.0	22,000	−	−	−
Randolph	Cattaraugus	Tap, public supply	7/27/14	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	550	+	−	−
Randolph	Cattaraugus	Tap, public supply	2/ 1/15	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	1,700	3+0−	2+1−	0+3−
Randolph	Cattaraugus	Tap, public supply	2/ 1/15	5	1	1 v.	1 v.	92	9	83	.002	.046	.001	0.30	2.10	1.38	67.1	67.0	2,300	3+0−	2+1−	0+3−
Randolph	Cattaraugus	Old reservoir, public supply	2/ 1/15	15	5	1 v.	1 v.	80	12	68	.004	.022	.001	0.30	4.70	1.25	57.1	56.0	4,200	3+0−	0+3−	0+3−
Randolph	Cattaraugus	Drilled well, public supply	3/ 1/15	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	10	0+3−	0+3−	0+3−

RICHMONDVILLE

HERMANN M. BIGGS, M.D., *State Commissioner of Health:*

A reinspection of the public water supply of Richmondville was made on October 8, 1914, by Dr. C. C. Duryee, sanitary supervisor of District "C," and the following report is based largely upon information furnished by him and by the previous reports. A full investigation of this supply was made by the Engineering Division in August, 1912, and the report of such investigation will be found on page 741 of the thirty-third annual report of this Department. Another still earlier inspection in connection with an outbreak of typhoid fever was made in April, 1909. (See page 490, volume 2 of the thirtieth annual report of this Department).

The water supply of this village is derived from an impounding and distributing reservoir fed by springs and a small surface stream, the reservoir being located about 3 miles northwest of the village. The waterworks system and the physical conditions in respect to it remain practically the same as at the time of the previous inspection.

The watershed tributary to this supply consists of about 1¾ square miles of hilly and wooded country. This area is crossed by two highways and by the D. & H. R. R. A portion of the land is used for farming purposes and cattle are pastured along the stream feeding the reservoir and around the reservoir itself. There are about six houses on the watershed and a total resident population estimated at 20.

The report of 1909 upon the investigation of typhoid fever pointed out that the probable cause of the outbreak was an infection of the public water supply and advised that every precaution be taken to abate the conditions at the various properties on the watershed which menaced the quality of the water.

The report of the investigation in 1912 pointed out the opportunity for considerable contamination of animal origin from pasture lands and animal enclosures, the occurrence of algae growths in the reservoir, and the location of two privies about 40 feet from the edge of the stream tributary to the reservoir. In this report it was recommended that a suitable fence be placed around the land adjacent to the reservoir in order to prevent access of cattle; that steps be taken to prevent the pollution of the stream by cattle and drainage from barnyards; that all possibility of dangerous pollution from privies or other sources be guarded against; that frequent and regular inspections be made by the board of water commissioners of the watershed in order to prevent incidental pollution; and that, if necessary, application be made to this Department for the enactment of rules and regulations for the protection from contamination of this supply.

The recent inspection by Dr. Duryee disclosed these facts; that a heavy wire fence has been erected which adequately prevents access of cattle to the reservoir itself; that a cattle lane, which passes along the northern slope above the reservoir, affords opportunity for contamination of animal origin, and that the two privies noted in the report of 1912 remain as described previously and are possible sources of dangerous contamination. While inspections of the watershed are made more or less frequently by the local authorities no application has been made to this Department for the enactment of rules and regulations.

At the time of the recent inspection samples of the water were collected for chemical analysis by Dr. Duryee and a few days later samples for bacteriological analysis were collected by Dr. W. F. Low, health officer, and the results of these analyses together with others made in the past two years by the Division of Laboratories and Research will be found in the appended table.

These results show a water supply rather high in color; always somewhat turbid and often highly turbid; with odors at times indicative of algae growths; usually moderately hard but frequently very hard; high in decomposing and decomposable organic matter; and with a chlorine content two to five times the normal in unpolluted waters of this region. The total bacterial

counts are practically always excessive even for a surface supply, and the frequent presence of organisms of the B. coli type in quantities of the water as small as 1 cubic centimeter and the occasional presence of these organisms in 1/10 cubic centimeter indicate considerable contamination by animal or human excreta.

Summarizing the results of the reinspection of this water supply it appears that in two particulars only, namely the construction of the fence around the reservoir and the inspections of the watershed, have the recommendations of the previous report been carried out by the local authorities. Apparently no attention has been paid to the recommendation that the supply be protected from animal pollution and from contamination from privies, nor do the records of this Department show that application has been made for the enactment of rules and regulations for the sanitary protection of the supply.

In view of the above the following conclusions may be drawn:

1. That the local authorities have failed to carry out the recommendations of the previous report save in certain comparatively minor points as noted above.

2. That the physical quality of the water supply of Richmondville is frequently unsatisfactory due to high turbidity, disagreeable tastes and odors from algae and drainage from pasture lands.

3. That the sanitary quality of this supply is menaced by the privies located near the stream tributary to the reservoir and by other sources of contamination incidental to an inhabited watershed.

I would, therefore, recommend:

1. That the local authorities take steps to improve the physical quality of the water as follows:

(a) By the construction of drainage ditches and the arrangement of a by-pass which will allow muddy surface wash to be directed around and away from the reservoir at times of heavy rainfall.

(b) By frequent and thorough flushing of all water mains in order to prevent accumulations of sediment in the mains themselves.

(c) By the relocation of the cattle lane north of the reservoir at such distance that drainage from it will not enter the reservoir.

(d) By the treatment of the water in the reservoir with copper sulphate, under the advice of an expert familiar with its use, whenever growths of algae give rise to tastes and odors.

2. That in order to protect the supply from opportunities for dangerous contamination the following measures be taken:

(a) The removal of all privies to at least 100 feet from any watercourse tributary to this supply and the arrangement of all privies on the watershed so that no drainage from them may reach the supply either directly or indirectly.

(b) The regular and frequent patrol of the watershed in order to prevent incidental, accidental or wilful contamination of the supply.

3. That in case any difficulty be experienced by carrying out the above measures, the local authorities request this Department to enact rules and regulations for the sanitary protection of the supply.

Respectfully submitted,

THEODORE HORTON,
Chief Engineer

ALBANY, N. Y., *January* 7, 1915

RESULTS OF WATER ANALYSES

Abbreviations used to describe odors of water: 0, none; 1, very faint; 2, faint; 3, distinct; 4, decided; 5, strong; 6, very strong; a, aromatic, d, disagreeable; e, earthy; f, fishy; g, grassy; m, musty; v, vegetable

Municipality	County	Source of sample	Date of collection	Physical				Chemical (Parts Per Million)											Bacteriological			
				Color	Turbidity	Odor		Solids			Nitrogen as—				Oxygen consumed	Chlorine	Hardness		Bacteria per c.c.; gelatin 20°, 48 hours	B. Coli Type + = present − = absent		
						Cold	Hot	Total	Loss on ignition	Mineral residue	Free ammonia	Albuminoid ammonia	Nitrites	Nitrates			Total	Alkalinity		10 c.c.	1 c.c.	1-10 c.c.
Richmondville	Schoharie	Tap, public supply	9/10/12	5	13	....	....	129	20	109	.046	.140	.001	0.06	4.20	2.75	84.3	79.0	1,700	+	+	+
Richmondville	Schoharie	Tap, public supply	11/16/12	5	5	....	....	62	14	48	.010	.064	.001	0.20	1.95	1.00	32.5	19.0	850	+	−	−
Richmondville	Schoharie	Tap, public supply	1/ 7/13	10	250	1 v.	1 v.	102	....	....	.024	.350	.002	0.26	5.40	1.00	20.8	11.0	7,000	3+0−	3+0−	3+0−
Richmondville	Schoharie	Tap, public supply	3/ 3/13	15	20	2 v.	2 v.	56	....	....	.016	.092	Tr.	0.36	3.10	1.50	36.4	28.0	1,900	1+2−	0+3−	0+3−
Richmondville	Schoharie	Tap, public supply	4/28/13	13	5	1 v.	1 v.	71	....	....	.006	.054	.001	0.10	1.70	1.00	35.1	29.0	475	0+3−	0+3−	0+3−
Richmondville	Schoharie	Tap, public supply	6/ 9/13	15	8	2 a.	2 a.	74	....	....	.024	.092	Tr.	0.06	2.10	1.00	33.8	32.0	900	3+0−	3+0−	0+3−
Richmondville	Schoharie	Tap, public supply	11/24/13	10	6	1 v.	1 v.	69	17	52	.010	.080	.001	0.24	2.80	1.50	29.9	20.0	475	3+0−	0+3−	0+3−
Richmondville	Schoharie	Tap, public supply	10/ 8/14	15	3	1 v.	1 v.	116	29	87	.008	.080	.001	0.20	2.60	2.00	70.0	60.0	......	......	......	......
Richmondville	Schoharie	Tap, public supply	10/ 8/14	18	80	1 v.	1 v.	177	26	151	.012	.200	.001	0.80	6.20	2.25	71.4	60.0	......	......	......	......
Richmondville	Schoharie	Tap, public supply	10/14/14	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	50	1+2	0+3−	0+3−
Richmondville	Schoharie	Tap, public supply	10/14/14	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	30	1+2−	0+3−	0+3−
Richmondville	Schoharie	Tap, public supply	10/14/14	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	230	1+2−	0+3−	0+3−
Richmondville	Schoharie	Tap, public supply	10/14/14	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	90	1+2−	0+3−	0+3−

RIVERHEAD

HERMANN M. BIGGS, M.D., *State Commissioner of Health:*

An investigation of the public water supply at Riverhead, Long Island, was made by Mr. C. M. Baker, assistant engineer on May 11, 1915.

The village of Riverhead is situated on the main line of the Long Island railroad at the head of Great Peconic bay, about seventy-five miles from New York City. The village is unincorporated but is provided with water according to the provisions of the town law. The present population is estimated at about 3,000 and is fairly constant, there being but little variation during the summer and winter.

The supply now being used is controlled by a private corporation but at the time of the inspection a new municipal supply was being developed by the village authorities and as the work was well under progress on this new supply and since it is planned to abandon the old system entirely, this report will deal principally with the new supply, only a brief description being given of the old supply which is now in use. The reason for abandoning the old supply is said to be due to the large amount of iron in the water.

The source of the new supply is to be wells, from which the water will be pumped through a purification plant for the purpose of removing iron, thence to a standpipe, whence it will be distributed by gravity through the mains to the consumers. At the time of the inspection the wells had all been constructed and the construction of the purification plant and standpipe was well under way. The work of laying the mains was also being carried on at the time of the inspection. No information was obtained as to the present water consumption and, therefore, in this discussion the probable consumption of the village will be assumed at 100 gallons per capita or a total of 300,000 gallons per day. The pressure developed with the new supply will be about 57 pounds. The plant is located in the western edge of the village, in a depression or low place which receives the drainage from the immediate vicinity.

There are three flowing 8-inch wells driven to a depth of 85 feet. The pressure on them, however, is only sufficient to cause the water to flow over the end of the pipe. There are in addition two 8-inch wells driven to a depth of 45 feet which do not flow. The strata through which the wells pass consist of sand for a depth of 45 feet, clay 45 to 55 feet and sand 55 to 85 feet. In the deep wells the water will be drawn through a 28-foot strainer extending from 55 to 75 feet below the surface, all of the water thus being drawn from below the clay stratum. The shallow wells, however, will draw their water from a depth between 17 feet and 27 feet below the surface. A 12-inch suction line will collect the water from the wells. Tapping this 12-inch line there will be an 8-inch suction to supply low duty pumps which will pump the water to an aerating tower whence it will flow by gravity into the settling basin. The settling basin is 30 by 45 feet in area with the flow line 6 feet above the bottom, and has a capacity of about 61,000 gallons, equivalent to 4.9 hours storage when based on an average water consumption of 300,000 gallons daily. The high duty pumps will draw the water from the settling basin or the basin may be by-passed and the water taken directly from the wells and force it through pressure filters to the standpipe. There are to be two filters so connected that either or both may be operated at one time or both be by-passed. Each filter is to be 8 feet in diameter by 20 feet long. The depth of the sand as shown on the plans is to be about three and one-half feet and the surface area in each filter about 130 square feet which will give a rate of filtration of about 100,000,000 gallons per acre per day when only one of the filters is in operation or one-half this rate when both are being operated. The standpipe consists of a 150,000-gallon steel, spherical bottom tank on a 125-foot tower. The water will be distributed from the standpipe through the mains to the consumers by gravity. The mains are to consist of approximately nine miles of pipe ranging in size from 6 to 14 inches in diameter.

The density of population on the area within one quarter of a mile of the wells is equivalent to 1,800 per square mile and within a radius of one-half mile is equivalent to 1,700 per square mile. Outside of this area and within the limit of the probable area of influence the population is somewhat less, being about 75 per square mile. A number of buildings from which pollution might easily reach the wells are located in the immediate vicinity of the plant. The sewage from these buildings is disposed of either by cess-pools or privies. One of the privies is located about 30 feet and another 40 feet from one of the deep wells, the distance from the nearest shallow well being about 100 feet. These privies are not provided with removable containers and were in an unsatisfactory condition at the time of the inspection. Two or three other houses also provided with insanitary methods for sewage disposal are located about 300 feet from the wells. The fact that the plant is located in a low place which receives drainage from the immediate vicinity is also objectionable from a sanitary standpoint, especially in view of the fact that the two privies located so close to the well are within this depressed area.

The old supply consists of driven wells located to the south of the Peconic river and just south of the main part of the village, the river, however, being between the main part of the village and the wells. The water is pumped from the wells into a standpipe located over a mill in the village. There is a density of population equivalent to about 1,160 per square mile within a radius of one-quarter of a mile and about 1,700 within a radius of one-half mile. The exact location of the wells could not be definitely determined, at least the information was not readily available and in view of the fact that this supply is soon to be abandoned a study was not made into details regarding this system.

A sample of water was collected from one of the wells at the new plant, located about the farthest from the immediate sources of pollution. It was impossible at the time of the inspection to collect samples from the other wells. A sample of water was also collected from the present supply. These samples were sent to the Division of Laboratories and Research for analyses, the result of which was as follows:

REPORT OF WATER ANALYSIS FOR RIVERHEAD

Source		Well, new supply	Old supply
Collected on		May 11, 1915	May 11, 1915
Color		Trace	3
Turbidity		Clear	5
Odor, cold		2 vegetable	1 vegetable
Odor, hot		2 vegetable	1 vegetable
Solids, total		56	54
Loss on ignition		6	5
Mineral residue		50	49
Ammonia, free		.028	.016
Ammonia, albuminoid		.008	Trace
Nitrites		.001	.001
Nitrates		1.02	0.02
Oxygen consumed		0.20	1.10
Chlorine		6.00	6.00
Hardness, total		28.60	22.10
Alkalinity		23.00	17.00
Iron		0.15	1.60
Bacteria per c.c		10	10
B. coli type	10 c.c.	0+3—	0+3—
	1 c.c.	0+3—	0+3—
	1/10 c.c.	0+3—	0+3—

Results are expressed in parts per million. + Present. — Absent.

Abbreviations used to describe odors of water: 0, none; 1, very faint; 2, faint; 3, distinct; 4, decided; 5, strong; 6, very strong; a, aromatic; d, disagreeable; e, earthy; f, fishy; g, grassy; m, musty; v, vegetable.

The results of the analyses of both samples indicate low figures for nitrogenous matter in the form of free and albuminoid ammonia, nitrites and nitrates, except possibly, that the figures for free ammonia are somewhat above normal. The chlorine is approximately equivalent to the normal for this locality. The bacterial content is low and the B. coli type were found present. The figures for iron are high in the water taken from the present or old supply but comparatively low in the new well.

These analyses indicate waters satisfactory from a sanitary standpoint for domestic purposes at the time the samples were collected although the presence of the large amount of iron in the old supply renders it unsatisfactory for laundry purposes. A single analysis does not indicate the character of the water at all times and under all conditions. It should also be pointed out that the sample taken here was from one of the deep wells the farthest removed from the source of contamination. It is quite possible that had samples been obtained from one of the shallow wells which are more directly subject to pollution than the others, the analyses would have shown contamination and a water unfit for domestic purposes. In fact it is quite probable that the pollution in the vicinity of the new supply will find its way into the wells, especially the shallow ones, when the wells are put into use, thus causing a cone of depression in the ground water level with the wells as a center, and resulting, within a certain area, in the water being drawn into the wells from all directions at a greater rate of flow than the normal flow of the ground water, thus allowing insufficient time for the purifying effect of the soil, to remove the pollution. Similar conditions of ineffective purification of water may also result at times of maximum flow of the ground water due to seasonal variation. While the clay stratum through which the deeper wells pass offers additional protection from such pollution, it is possible that under certain conditions polluted ground water may find its way into, through or around this stratum, because of pervious area in it or possible channels through it caused by improperly protected wells in the vicinity.

It is unfortunate that the plant has been located in a place so unsuitably adapted to the procuring of a pure and satisfactory supply. The dense population in the immediate vicinity causes a source of potential danger which may at any time become active, especially where the method of sewage disposal consists of cesspools and privies as it does in this locality. While it is possible that with proper care and rigidly enforced rules regarding the disposal of sewage in the immediate vicinity of the wells, the purifying effect of the soil may render inactive the pollution which reaches the ground water, there is, nevertheless, an increasing amount or accumulation of this pollution which may eventually cause active contamination of the supply. Under the circumstances, therefore, it appears advisable that the village authorities provide proper disposal of sewage in the vicinity. The settling basins and pressure filters will undoubtedly have considerable bacterial efficiency thus offering a safeguard to the supply. Great care should, therefore, be exercised in the operation of the purification plant to obtain at all times its maximum efficiency and analytical control should be provided.

In view of the above it is evident that the new water supply being developed at Riverhead is unfortunately located in that it is so directly subject to the possibility of pollution from privies and cesspools in the immediate vicinity; but it is possible that by providing more sanitary methods of sewage disposal for these places, with proper operation of the purification plant and with effective control by means of frequent analyses a satisfactory supply can be obtained. I therefore, beg to submit the following recommendations:

1. That the village authorities proceed to eliminate the source of contamination within a radius of 500 feet of the wells by

(a) Requiring all cesspools to be of watertight construction and all privies to be provided with watertight, removable containers; and subsequently the removal and satisfactory disposal of the contents from these receptacles in some remote place; or preferably

(b) The installation of sewerage system properly designed and constructed, the plans for which should be approved by this Department as is required by law.

2. That great care be exercised at all times to obtain the maximum efficiency of the purification plant.

3. That analyses of the water be regularly made occasionally during the year.

(a) To detect any undue contamination which may occur in the raw water.

(b) To determine the efficiency and control the operation of the purification plant.

4. That should such contamination occur at any time and the present purification plant prove insufficient to remove it, steps be taken immediately.

(a) To determine and eliminate the source of pollution, if possible, or

(b) Supplement the present treatment by sterilization with liquid chlorine.

(c) Should the above improvements fail to render the supply satisfactory new wells or other supply free from pollution be developed.

A sewer system for collecting and satisfactorily disposing of the sewage of the village would undoubtedly remove to a great extent the present sources of pollution and thus greatly reduce the possibility of the supply becoming dangerously contaminated. It would therefore seem advisable that, in any case, the village authorities consider the advisability of constructing such a system.

Respectfully submitted,
THEODORE HORTON,
Chief Engineer

ALBANY, N. Y., *June* 21, 1915

ROCHESTER & LAKE ONTARIO WATER COMPANY

HERMANN M. BIGGS, M.D., *State Commissioner of Health:*

An investigation of the public water supply furnished by the Rochester and Lake Ontario Water Company was made on June 25 and 26, 1915, by Mr. Morton F. Sanborn, assistant engineer. The assistant engineer was assisted by Mr. C. V. Patchin, sanitary supervisor; Dr. J. E. Ottaway, health officer of the village of Charlotte; J. F. Amos, chief engineer of the pumping and filtration plant; Alvin H. Dewey, general manager, and George H. Bliven, superintendent of the water company.

The water is pumped from Lake Ontario to the filter plant located on the shore of the lake about 1.3 miles west of the outlet of the Genesee river. After filtration the water is distributed by pumping to the following municipalities and water districts: Villages of Charlotte, East Rochester, Pittsford, Fairport (industries and hotels); town of Penfield; water supply districts, Summerville in town of Irondequoit; Sea Breeze and vicinity in town of Irondequoit; Clover street and Monroe in town of Brighton; Ridge road in town of Greece; franchises in the towns of Greece, Gates, Brighton, Pittsford, Perrington and Irondequoit; and to those parts of the city of Rochester which have been annexed in recent years.

It is estimated that there are about 25,000 people supplied with this water besides several industries and manufacturing establishments and the New York Central and Hudson River railroad uses from 800,000 to 1,000,000 gallons per day. The average daily consumption varies from 4,500,000 gallons per day during the winter months to 5,250,000 gallons per day during the summer. Deducting the amount used by the N. Y. C. & H. R. R. R. it is estimated that the per capita consumption is about 150 gallons per day and it is probable that a considerable portion of the water is used in the industries. These figures on water consumption were obtained from the readings of the Venturi meter located at the pumping station and the consumption as obtained from the local meters has been from 5 to 20 per cent. less than

that obtained at the pumping station. All water sold by the water company is metered either to the individual consumer or to the municipalities or water districts.

The water is pumped from the lake to a settling basin. From there it flows to a pump well and is then pumped through the filter to the distributing mains and to the reservoir which is located on Cobbs Hill southwest of the city of Rochester. There are about 100 miles of water mains ranging in size from 2 inches to 20 inches.

The pumping station, filter plant and distributing mains were designed and constructed by the American Pipe and Construction Company of Philadelphia and the plant was completed and placed in service in 1904.

A chief engineer in charge, three engineers, three firemen, one oiler and one assistant chemist are employed at the plant. James M. Caird of Troy is the consulting chemist of the water company and visits the plant three or four times a year. Either the chief engineer or the assistant chemist makes daily chemical and bacteriological tests of the raw, treated and filtered water.

The intake extends about 4,000 feet into the lake and consists of a 24-inch pipe laid in a trench in the bottom of the lake. The outer end or intake of the pipe consists of a quarter bend around which had been constructed a crib 18 feet square. The top of this crib consists of 2-inch by 6-inch timbers which are placed on edge so as to give parallel openings between the timbers of about 1 inch. The intake end of the pipe is about 38 feet under water.

The pumping station is a substantial stone building about 50 x 200 feet in plan. The station is divided into three parts, the smaller part, located at the north end of the station, is used for the boiler room; the central and larger portion is used for the pumping engines; and in the southerly end are located the filters.

The boilers consist of three 300 horsepower Babcock & Wilcox horizontal tubular boilers, two of which are used continuously while the third is held in reserve.

boilers, two of which are used continuously while the third is held in reserve.

The water is raised about 12 feet to the sedimentation basin by low lift pumps which are located in the basement of the pumping station. One of these pumps is a Gould centrifugal pump of 6,000,000 gallons capacity with 12-inch suction and discharge pipes and is driven by a 75 horsepower electric motor. The other pump is a 5,000,000 gallon Morris centrifugal pump with a 12-inch suction and a 10-inch discharge and is driven by a 30 horsepower steam engine.

The high lift pumps consist of two Robert Wetherell cross compound 3,000,000 gallon pumps, fly wheel type, which have 24-inch high and 42-inch low pressure cylinders, 30-inch stroke and 11-inch water cylinders. There is also one Nordberg variable 5,000,00 gallon pump. This pump has a 16⅛-inch water cylinder and 18-inch stroke and is driven by a 600 horsepower electric motor. These high service pumps force the water against a static pressure of 172 pounds. The actual pressure as shown by the gauge when the pumps are in operation will vary from 225 pounds during the day to 240 pounds during the night.

The sedimentation basin is uncovered and is constructed of timber. It is built above the ground and is located east of the pumping station. The basin is 202 feet long, 48 feet wide and has an available depth of about 5½ feet. It is divided longitudinally by three partitions so as to form one long tank about 12 feet wide and gives three changes of direction of flow as the water passes through the basin. In the first and second lines of flow there are four baffles, the first and third baffles extend from the bottom of the tank up to within about one foot of the surface, and the second and fourth baffles extend from the surface down to a point about 2 feet below the surface. This basin is for the purpose of facilitating the removal of any matter which will readily settle out of the water and also for the removal of that part of the coagulant which can be removed by sedimentation. It is stated by the officials of the company that they intend soon to construct a concrete sedimentation basin with two compartments to replace the present basin of timber.

The raw water is treated with hypochlorite of lime as it passes under the laboratory house and before it enters the settling basin. The average dose for the last few months has been about 0.25 part per million of available chlorine.

Sulphate of aluminum in solution is also applied at this point at such times as the water has much turbidity. The amount of this chemical used varies from 0 to 2 grains per gallon and the amount to be used is determined by the turbidity of the water and the use of a chart which gives the amount necessary as shown by previous experimentation. The bleach is used practically all the year while the sulphate of aluminum is used principally during the winter months at which times the turbidity is higher and the bacterial count is also greater.

There are two tanks 5 feet in diameter and 14 feet high for the sulphate of aluminum solution and a similar tank for the bleach solution. The latter tank is lined with concrete and the bleach solution is continually stirred by a motor-driven agitator. The flow from these tanks is regulated by float valves and hard rubber orifices which are adjusted to suit the required conditions of flow.

The filters are of the mechanical pressure type and consist of 8 horizontal iron tanks, 8 feet in diameter and 24 feet long, with a rated capacity of 500,000 gallons per day each. The bottom of the tanks are covered with concrete through which extends the drain pipe and the strainers. There are 600 strainers in each of the filters. Immediately above the strainers is about one foot of graded gravel from 1/8 to 3/4 inches in size. Above this gravel there is about 3½ feet of sand, having an effective size of .38 mm. and a uniformity coefficient of 1.9. The influent and effluent pipes are 8 inches in diameter and the laterals to the strainers are 1¼ inches in diameter. The valves regulating the operation of the filters are operated by hand with the exception of the valve in the effluent pipe which is a hydraulic valve. This hydraulic valve is operated by a regulating device which permits a pressure of about 20 pounds when the filters are being washed.

The rate of filtration with the 8 filters in use varies from 127,500,000 to 148,700,000 gallons per acre per day. The filters are cleaned about twice a day when the water is turbid and the coagulant is being used, while during the periods when the water is practically clear and no coagulant is used the filters are cleaned every two or three days. There is no loss of head device to indicate the need of cleaning the filters. The filters are cleaned by a reverse flow of filtered water through the filters. The reverse flow continues until the wash water runs comparatively clear as determined by observing some of the wash water in a glass, the length of time required varying from 5 to 10 minutes. There is no agitation of the sand by means of air or rakes, the force of water alone being depended upon to clean the sand. The amount of wash water used amounts to about 1,200 gallons per minute. This would give a per cent. of the total water pumped varying from .66 per cent. in the summer to 3.52 per cent. in the winter. The first water filtered after a filter is cleaned is not wasted, but it is pumped with the rest of the filtered water to the mains.

Copper sulphate is used about six times a year in the sedimentation basin to remove the algae growth which occasionally accumulated in the basin or is brought in from the lake. This chemical is used to an amount not exceeding 9 pounds per million gallons which is equal to 1.08 parts per million. The amount used depends upon the character and appearance of the algae present.

The sedimentation basin has usually been cleaned twice a year although the last two years the basin has been cleaned but once a year. At the time of the inspection the basin contained from one to three feet of sediment and gas bubbles could be seen rising occasionally from the sediment to the surface of the water. In front of the surface baffles a scum had formed which extended from the baffles back over the surface about 8 feet. This scum apparently was an algae growth and gave a very fishy odor. This basin will give a theoretical detention period varying from 2 hours and 10 minutes to 1 hour and 50 minutes depending upon the time of the year. At the time of the inspection, however, due to the sediment in the basin the theoretical detention period was reduced to about 1 1/3 hours. The tank is cleaned by washing the sediment out into a small pond from whence the water and part of the sediment passes to the lake.

The reservoir on Cobbs hill is constructed of iron, and is 150 feet in diameter and 20 feet high. The reservoir is uncovered and has a capacity of about 2,560,000 gallons. The bottom of the reservoir is about 413 feet above the surface of Lake Ontario and acts principally as an equalizing reservoir and maintains a pressure throughout the system varying from 50 to 200 pounds.

The village of Charlotte and the Summerville water districts have reducers while all of the other villages, water districts and individuals are connected directly to the main and have no reducers except where installed by individuals.

Since the water for this supply is taken from Lake Ontario the extent and character of the watershed is so well known that no description of it will be given. The greater part of the sewage of the city of Rochester is at present discharged into the Genesee river about 7 miles from Lake Ontario. The flow of the river water as it enters the lake is chiefly out into the lake in a northeast direction and away from the intake of this water supply. During strong east or northeast winds, however, a considerable amount of sewage must necessarily reach the location of the intake. It is expected that by another year or two practically all of the sewage from Rochester will, after treatment, be discharged into the lake about 1½ miles off shore and about 3 miles east of the intake of the water company.

At the time of the inspection samples of the raw and filtered water were collected for complete analyses and samples at various points in the treatment and purification process were also taken for bacteriological analysis. These analyses together with analyses previously made by the Division of Laboratories and Research will be found in the appended table.

From the recent analyses it will be seen that although the filtered water is, in general, improved in character yet there were one or two tests which gave poorer results than the raw water. This is shown by the increase in the odor from 1 to 2 and by the number of bacteria which first decreased from 150 to 10 upon applying the disinfectant and then increased to 450 after passing through the settling tank, to 650 after passing through the filters, and to 4,900 at the railroad station. This increase in odor and number of bacteria is undoubtedly due to the condition of the settling tank with the sediment in the bottom and the scum of algae on part of the surface. From analyses made in previous years bacteria of the B. coli type have occasionally been found in samples as small as 1 c. c. of the filtered water. This condition has usually occurred during the winter months and shows the necessity of increasing the amount of hypochlorite of lime during the periods of much turbidity.

As a result of this investigation and of the results of the analyses made of the raw and filtered water in recent years the following conclusions may be drawn:

1. That the water in the lake is not safe to use at any time without adequate purification.
2. That at times of east or northeast storms considerable pollution of the lake water in the vicinity of the lake is caused by the sewage which is discharged into the Genesee river and this pollution is generally much greater during the winter than during the summer.
3. That after the city of Rochester discharges the settled sewage through the new sewer outlet, the frequency of the pollution of the lake water at the intake will probably be somewhat reduced, yet during east or northeast storms the pollution may be as great or nearly so as with the present method of discharge.
4. That use of a disinfectant in the water is advisable at all times and for very turbid raw water the amount of bleach should be increased so as to give .4 to .5 parts per million of available chlorine.
5. That the present system of testing and inspection of the character of the water apparently gives a satisfactory method of control for applying the sulphate of aluminum to turbid waters.
6. That decomposition of the sediment in the settling basin and the algae scum on the surface apparently caused a deterioration of the quality

of the water as shown by the increases in odors and in the number of bacteria. This condition is probably made more acute by the action of the sunlight in stimulating algae growths and by summer temperatures hastening the decomposition of organic matter in the sediment.

7. That the filters are being operated at a somewhat greater rate than is considered good practice for filters of this type.

In view, therefore, of the above conclusions I would recommend that the Rochester & Lake Ontario Water Company make the following changes in the construction and operation of the filtration plant:

1. That at least .25 parts of available chlorine be used at all times and that when the raw water is very turbid the amount of available chlorine be increased to from .4 to .5 parts per million.

2. That the settling basin be cleaned out more frequently and especially in the spring, after the use of the sulphate of aluminum; and also that any scum forming on the water in the basin be removed. If, after the employment of such methods in addition to the use of copper sulphate, the trouble is not remedied the company should cover the basin to exclude sunlight.

3. That additional filter capacity be provided in case of a material increase in the daily consumption of water.

4. That, due to the variations in the character of the raw water and to the liability of serious pollution at times continued expert supervision of the plant and analyses of the water should be maintained constantly so that, in the operation of the plant, proper allowance may be made for such variations.

Respectfully submitted,

THEODORE HORTON,
Chief Engineer

ALBANY, N. Y., *August* 13, 1915

Results of Water Analyses

Abbreviations used to describe odors of water: 0, none; 1, very faint; 2, faint; 3, distinct; 4, decided; 5, strong; 6, very strong; a, aromatic, d, disagreeable; e, earthy; f, fishy; g, grassy; m, musty; v, vegetable

Municipality	County	Source of sample	Date of collection	Physical				Chemical (Parts Per Million)												Bacteriological			
						Odor		Solids			Nitrogen as—						Hardness				B. Coli Type + = present — = absent		
				Color	Turbidity	Cold	Hot	Total	Loss on ignition	Mineral residue	Free ammonia	Albuminoid ammonia	Nitrites	Nitrates	Oxygen consumed	Chlorine	Total	Alkalinity	Bacteria per c.c.: gelatin 20°, 48 hours	10 c.c.	1 c.c.	1-10 c.c.
Charlotte*	Monroe	Raw water	9/18/12	10	5	....	....	164	....	143	.008	.064	.001	0.04	2.00	8.00	108.6	91.0	3,100	+	+	+
Charlotte	Monroe	Filtered water	9/18/12	10	1	....	....	182	....	156	.004	.070	.001	0.04	2.00	9.25	105.8	92.0	....	—	—	—
Charlotte	Monroe	Raw water	11/20/12	10	15	....	....	156	....	122	.036	.096	.001	0.10	1.90	8.75	111.4	96.0	76,000	+	+	+
Charlotte	Monroe	Filtered water	11/20/12	5	Cl.	....	....	169	....	132	.046	.090	.001	0.12	1.60	9.75	120.0	95.0	6,200	+	+	—
Charlotte	Monroe	Raw water	1/ 7/13	10	30	....	....	152	....	....	.042	.104	.002	0.12	3.40	11.00	101.5	91.0	9,000	+	+	+
Charlotte	Monroe	Purified water	1/ 7/13	5	3	....	....	151	....	....	.034	.080	.001	0.16	2.00	11.25	108.6	88.0	750	+	+	—
Charlotte	Monroe	Raw water	3/ 4/13	5	10	....	....	148	....	....	.008	.068	Tr.	0.12	2.00	6.75	100.0	93.0	100	+	—	—
Charlotte	Monroe	Purified water	3/ 4/13	Tr.	Cl.	....	....	149	....	....	.020	.052	Tr.	0.14	1.90	7.50	102.8	88.0	20	—	—	—
Charlotte	Monroe	Raw water	4/15/13	3	80	....	....	172	....	....	.040	.124	.001	0.12	3.80	7.25	108.6	91.0	6,800	+	+	+
Charlotte	Monroe	Purified water	4/15/13	2	2	....	....	164	....	....	.038	.062	Tr.	0.14	1.60	8.00	108.6	80.0	10	—	—	—
Charlotte	Monroe	Raw water	6/ 3/13	5	3	....	....	142	....	....	.010	.064	Tr.	0.06	1.30	7.50	97.2	91.0	100	+	—	—
Charlotte	Monroe	Filtered water	6/ 3/13	Tr.	Cl.	....	....	138	....	....	.010	.054	Tr.	0.08	1.30	7.50	94.3	89.0	50	—	—	—
Charlotte	Monroe	Raw water	4/22/14	Tr.	15	1 a.	1 a.	150	27	123	.016	.104	.001	0.14	3.10	7.50	102.8	93.0	1,200	+	—	—
Charlotte	Monroe	Filtered water tap over sink in pump room	4/22/14	Tr.	12	1 v.	1 v.	150	25	125	.014	.084	.001	0.14	2.10	7.75	105.8	87.0	350	+	—	—
Charlotte	Monroe	Raw water	6/25/15	5	Tr.	1 v.	1 v.	125	13	112	.010	.060	.001	0.10	2.40	8.00	100.0	93.0	150	+	—	—
Charlotte	Monroe	Treated water (bleach)	6/25/15	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	10	—	—	—
Charlotte	Monroe	Treated and settled water	6/25/15	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	450	—	—	—
Charlotte	Monroe	Treated and filtered water	6/25/15	Tr.	Cl.	2 v.	2 v.	146	10	136	.002	.034	.003	0.06	2.30	8.00	85.70	84.0	650	—	—	—
Charlotte	Monroe	Tap at N. Y. C. & H. R. R. station	6/25/15	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	4,900	—	—	—

* Rochester & Lake Ontario Water Co. at Charlotte

ROCKVILLE CENTER

HERMANN M. BIGGS, M.D., *State Commissioner of Health:*

An investigation of the water supply of Rockville Center, L. I., was made by Mr. C. M. Baker, assistant engineer, on May 14, 1915.

Rockville Center is located in the county of Nassau, on the Montauk branch of the L. I. R. R., about 21 miles from New York city. The village has a population of about 4,300, which, however, increases somewhat, possibly to 5,000, during the summer months, due to residents from the city. The water plant, which is located not far from the center of the village, is operated by the village in connection with the municipal electric lighting plant. The supply is derived from driven wells, from which the water is pumped into a standpipe, whence it is distributed by gravity through the mains to the consumers. Practically all of the population is served with the water, there being a total of 1,325 service taps, of which only 88 are metered. The water consumption averages about 395,000 gallons daily during the winter and 726,000 gallons during the summer, corresponding to per capita rates of 92 and 145 gallons daily respectively. The water pressure averages about 43 pounds, varying somewhat, however, with the elevation of the water in the standpipe.

There are two 8-inch wells, also a 6-inch and a 4-inch well, all of which are driven through sand to a depth of about 44 feet. The water is drawn from the wells and forced into a standpipe by two pumps, one of which has a capacity of 1,000 gallons per minute and the other 600 gallons per minute. The suction lift of the pumps is about 18 or 20 feet. The standpipe is constructed of steel, is 20 feet in diameter, 100 feet high and has a capacity of about 230,000 gallons. The water is distributed through the village by some 26 miles of mains which range in size from 4 to 10 inches in diameter.

The density of population within a radius of ¼ of a mile of the wells is about 1,880 persons per square mile and within one-half mile, 1,140 per square mile. Outside of this area and within the limits of the probable area of influence the population is approximately 100 per square mile. The sewage from the population in this vicinity is disposed of by means of cesspools and privies. The plant is located on a plot of land about 250 feet square, the wells being toward the southern side of this area. A privy at the power plant is provided with a brick vault which is apparently tight and is located about 150 feet from the wells. A privy on the adjoining property is located at a distance of about 200 feet from the wells and is provided with an earth vault. These appear to be the possible sources of pollution in the immediate vicinity of the wells. The dense population surrounding the wells, however, necessarily causes considerable pollution of the ground water from which the supply is drawn, especially with the present methods of sewage disposal.

A sample of the water was collected and sent to the Division of Laboratories and Research for anaylsis, the results of which are as follows:

REPORT OF WATER ANALYSIS FOR ROCKVILLE CENTER

Source		Tap at pumping station
Collected on		5/14/15
Color		Trace
Turbidity		Clear
Odor, cold		1 v.
Odor, hot		1 v.
Solids, total		96
Loss on ignition		12
Mineral residue		84
Ammonia, free		.028
Ammonia, albuminoid		.006
Nitrites		.001
Nitrates		3.60
Oxygen consumed		1.00
Chlorine		12.00
Hardness, total		27.30
Alkalinity		3.00
Bacteria per c.c.		25
B. coli type	10 c.c.	0+3—
	1 c.c.	0+3—
	1/10 c.c.	0+3—

Results are expressed in parts per million. + Present. — Absent.
Abbreviations used to describe odors of water: 0, none; 1, very faint; 2, faint; 3, distinct 4, decided; 5, strong; 6, very strong; a, aromatic; d, disagreeable; e, earthy; f, fishy; g, grassy; m, musty; v, vegetable.

The results of analyses indicate a water satisfactory in physical quality. The figures for free ammonia, nitrates and chlorine are considerably above the normal, the figure for chlorine being practically two times the normal for this locality. The bacterial analysis shows a low bacterial content and the absence of the B. coli type at the time the sample was taken. The high figures for free ammonia, nitrates and chlorine, however, indicate that pollution has found its way into the supply and although the bacterial results indicate that this contamination was not dangerous at the time the sample was taken, the high figure for free ammonia indicates the presence of undecomposed organic matter and suggests that the pollution is becoming somewhat active.

Samples of soil taken from various wells in this vicinity indicate that the strata for a depth of about 50 feet are composed of comparatively fine sand which is generally quite uniform in size. The low bacterial content is thus undoubtedly due to the purifying action of the soil during the passage of the water through it. With such a large amount of pollution present, however, and with the constant accumulation of such pollution in the ground water it is probable that the soil will not continue effective at all times in purifying the water. In fact, it is quite possible, at certain seasons of the year when the flow of ground water is at a maximum or at times of maximum consumption when there is an excessive draft on the wells, that the rate of flow may be so great as to allow insufficient time for satisfactory purification of the water.

In order to properly safeguard this supply the sources of pollution in the vicinity of the wells should be removed by an adequate and sanitary method of collecting and disposing of all sewage. The effectiveness of the method of sewage disposal and the quality of the water should be checked by occasional analyses of the water at regular intervals during the year and should contamination be found present at any time, steps could then be taken to further safeguard the supply by purification which could, doubtless, be accomplished by the use of liquid chlorine.

As a result of this investigation it appears that the densely populated area with its present method of sewage disposal in the vicinity of the wells, causes intense pollution of the ground water. The analysis of the water taken from the wells at the time of the inspection, however, indicates that this pollution had been well purified before reaching the wells, nevertheless,

it is quite possible that, under different hydraulic conditions of the ground water, this pollution may become active and dangerous. I beg, therefore, to submit the following recommendations:

1. That the sources of pollution of the ground water in the vicinity of the wells be removed

   (a) By providing water-tight containers for all privies and reconstructing all cesspools within 500 feet of the wells so that they are impervious, also by regularly removing the contents from these places at proper intervals and disposing of the same in a satisfactory and sanitary manner in some remote place; or preferably

   (b) By a properly designed and constructed sewerage system, the plans for which should be approved by this Department as is required by law.

2. That analyses of the water be occasionally made during the year to detect any active or dangerous contamination which may occur.

3. That should the analyses at any time show such contamination of the water, steps be immediately taken

   (a) To determine and eliminate the source of the contamination if possible, or if the contamination continues,

   (b) Sterilize the supply with liquid chlorine or by some other satisfactory method.

   (c) To develop new wells or other new supply of a satisfactory quality, favorably located with respect to sources of pollution. If the above improvements do not render the supply satisfactory.

Respectfully submitted,

THEODORE HORTON,
Chief Engineer

ALBANY, N. Y., *June* 28, 1915

ROME

HERMANN M. BIGGS, M.D., *State Commissioner of Health:*

A reinspection of the public water supply of Rome was made on August 25, 1915, by Dr. J. E. Clark, sanitary supervisor of district E." A previous inspection of this supply made made by Professor H. N. Ogden, in connection with an investigation of the sanitary condition of the city as affected by this water supply. The report of this earlier inspection will be found on page 974 of the thirty-third annual report of this Department.

The water supply of Rome is derived from Fish creek, the intake being located about 13 miles northwest of the city. From this intake the water is distributed by gravity to the city. The waterworks system in general remains practically the same as described in the earlier report.

Fish creek above the water works intake has an estimated watershed area of about 156 square miles. This area consists of gently rolling hills largely of glacial origin. Although the area is crossed by several highways it is, for the most part, sparsely populated. Rules and regulations for the sanitary protection of the watershed were enacted by this Department in 1899. The city authorities have maintained frequent inspections of the watershed and have carefully enforced the provisions of the rules and regulations. At the time of the reinspection, Dr. Clark found but three violations of the water rules and these of minor importance. Steps were immediately taken to abate these violations. However, in order to guard against all possibilities of accidental, incidental or wilful contamination of the water supply, the city is considering the installation of a chlorination plant for sterilization of the supply.

The previous report recommended that frequent inspections be made of the watershed and that such sources of contamination as might be found to

exist be abated as rapidly as possible. From the report of Dr. Clark it appears that these recommendations have been carried out.

At the time of his inspection Dr. Clark collected samples of water and the results of the analyses of these samples together with others made in the past by the Division of Laboratories and Research will be found in the appended table.

These analyses show a water very high in color, usually free from turbidity and moderately soft. The figures for nitrogen in its various forms and for oxygen consumed are comparatively high, indicating considerable amounts of decomposing and decomposable organic matter. These results, however, are consistent with the conditions upon the watershed and are probably due to the comparatively large amount of swampy area thereon. The total bacterial counts are high and fecal organisms of the B. coli type are usually present in 10 c. c. and frequently in 1 c. c. indicating the occurrence of a certain amount of active contamination of animal or human origin.

In view of the above facts the following conclusions may be drawn:

1. That the city authorities of Rome have taken commendable steps towards maintaining regular sanitary patrol of the watershed and toward the removal of sources of contamination thereon.

2. That the water supply of Rome, although subject to little contamination from permanent sources, is, as is true of many surface water supplies, open to accidental or wilful contamination incidental to a populated watershed.

I would therefore recommend:

1. That the city authorities continue their careful and regular patrol of the watershed in order to detect and abate all sources of contamination.

2. That in order to eliminate the danger from accidental, incidental or wilful contamination, the city install and carefully operate suitable apparatus for sterilization of the supply with liquid chlorine.

Respectfully submitted,

THEODORE HORTON,
Chief Engineer

ALBANY, N. Y., *December* 6, 1915

RESULTS OF WATER ANALYSES

Abbreviations used to describe odors of water: 0, none; 1, very faint; 2, faint; 3, distinct; 4, decided; 5, strong; 6, very strong; a, aromatic; d, disagreeable; e, earthy; f, fishy; g, grassy; m, musty; v, vegetable

Municipality	County	Source of supply	Date of collection	Physical				Chemical (Parts per Million)												Bacteriological			
						Odor		Solids			Nitrogen as—						Hardness			B. Coli Type + = present — = absent			
				Color	Turbidity	Cold	Hot	Total	Loss on ignition	Mineral residue	Free ammonia	Albuminoid ammonia	Nitrites	Nitrates	Oxygen consumed	Chlorine	Total	Alkalinity	Bacteria per c.c.: gelatin 20°, 48 hours	10 c.c.	1 c.c.	1-10 c.c.
Rome	Oneida	Tap, public supply	2/ 6/12	22	Cl.	....	....	45	14	31	.008	.054	Tr.	0.34	3.10	1.00	30	27	190	+	—	—
Rome	Oneida	Tap, public supply	3/18/12	20	Cl.	....	....	46	10	36	.016	.054	Tr.	0.48	3.40	0.50	35	28	2,700	+	—	—
Rome	Oneida	Tap, public supply	5/ 1/12	35	5	....	....	38	16	22	.006	.084	Tr.	0.16	6.40	0.50	18	8	600	+	—	—
Rome	Oneida	Tap, public supply	9/24/12	40	Cl.	....	....	75	33	42	.006	.128	.001	0.08	10.0	0.62	40	31	3,700	+	+	—
Rome	Oneida	Tap, public supply	10/29/12	75	Tr.	....	....	70	26	44	.014	.166	Tr.	0.10	11.8	1.50	31	21	32,000	+	+	—
Rome	Oneida	Tap, public supply	11/15/12	60	Cl.	....	....	46	19	27	.016	.098	Tr.	0.12	8.80	0.75	26	23	80	+	—	—
Rome	Oneida	Tap, public supply	11/30/12	35	Cl.	....	....	55	11	44	.008	.084	Tr.	0.20	5.60	0.62	33	26	190	+	+	—
Rome	Oneida	Tap, public supply	12/27/12	35	Cl.	....	....	44	14	30	.024	.078	.001	0.20	5.50	0.50	26	21	8,600	+	+	—
Rome	Oneida	Tap, public supply	2/ 4/13	25	Tr.	....	....	40	....	....	.012	.060	Tr.	1.20	5.40	0.50	23	15	250	+	—	—
Rome	Oneida	Tap, public supply	3/18/13	25	7	....	....	44	....	....	.022	.060	.001	0.20	5.30	0.25	18	13	10,500	+	+	—
Rome	Oneida	Tap, public supply	5/21/13	20	Cl.	....	....	53	....	....	.006	.038	Tr.	0.14	2.10	0.50	35	33	70	—	—	—
Rome	Oneida	Tap, public supply	7/22/13	20	Tr.	....	....	63	....	....	.006	.074	Tr.	0.12	4.60	0.75	43	38	*......	+	—	—
Rome	Oneida	Tap, public supply	4/27/14	40	5	1 a.	1 a.	51	25	26	.020	.104	.001	0.24	7.80	0.25	22	11	1,100	+	—	—
Rome	Oneida	Tap, public supply	6/17/13	23	2	....	....	57	....	....	.006	.058	Tr.	0.04	4.20	0.37	35	34	3,100	+	+	—
Rome	Oneida	Tap, public supply	7/13/14	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	*42,000	+	+	—
Rome	Oneida	Tap, public supply	7/13/14	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	*16,000	+	+	—
Rome	Oneida	Tap, public supply	11/ 4/14	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	5,720	+	—	—
Rome	Oneida	Tap, public supply	2/ 5/15	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	220	+	—	—
Rome	Oneida	Tap, public supply	4/30/15	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	1,500	+	+	—
Rome	Oneida	Tap, public supply	4/30/15	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	950	+	+	—
Rome	Oneida	Tap, public supply	8/25/15	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	450	3+0—	3+0—	1+2—
Rome	Oneida	Reservoir	8/25/15	35	1	2 v.	2 v.	95	10	85	.042	.190	.001	0.10	13.8	1.25	33	25	950	3+0—	3+0—	1+2—

* Delayed in transit.

ROSENDALE

HERMANN M. BIGGS, M.D., *State Commissioner of Health:*

A reinspection of the public water supply of Rosendale was made on June 28, 1915, by Dr. C. W. Berry, sanitary supervisor of District "N." A previous investigation of this supply was made in 1912 by the Engineering Division, a full report of which will be found on page 746 of the thirty-third annual report of this Department.

The public water supply of this village is derived from two sources, one a small reservoir largely spring fed in the southeast portion of the village, the other a larger reservoir which impounds the water of a surface stream about 1¼ miles south of the village in the Shawangunk mountains. The elevation of the small reservoir near the village was raised 3 feet in 1912 but the elevation is still insufficient to furnish adequate pressure for fire protection. The principal supply of the village for domestic use is obtained from this reservoir and the water in the Shawangunk reservoir is reserved for fire protection and is used to supply a few houses in the higher part of the village. The description of the various sources of supply and of the waterworks system in general remains practically the same as described in detail in the earlier report. In 1912 however, a new dam was built across the stream in the Shawangunk mountains about 500 feet above the old structure. This new dam forms a reservoir which provides additional storage and which also serves as a sedimentation basin.

The watershed tributary to the small reservoir is approximately 70 acres in area. This area is uninhabited and for the most part is covered with trees of large growth. The watershed is directly adjacent to the village and is under the supervision of the superintendent of water works who makes almost daily inspections in order that any contamination may be prevented. No use is made of the adjoining woods for picnic parties and signs warning against trespassing are conspicuously displayed.

The watershed tributary to the larger reservoir is a narrow depression between two ridges of mountains. The surface is rough and in many places precipitous. The soil is very thin and rocky and the area is well covered with second growth timber. The total area of this watershed is about 0.7 square miles. There are but two houses on this watershed, one of which is owned by the village and occupied by a tenant. This house is about 300 feet from the stream on an unimproved road leading from the State highway and about ⅛ mile north of the reservoir. Sanitary conditions at this house were found to be satisfactory and no indications of any contamination of the stream were found to be present. Inspections are made occasionally by the water commissioners or the health officer. The other house on the watershed is about ⅜ of a mile further south at the end of the branch road. This house is situated on rather level land about 100 feet from the stream. The barn is a little farther north and on the other side of the road nearer the brook. The barnyard extends across the stream and drainage from it enters the stream directly as does the drainage from a hogpen along side the barn. The privy vault was formerly situated directly on the stream but two years ago was removed to the rear of the house, 150 feet from the stream and its former site cleaned and filled in.

The earlier report pointed out the possibilities of serious contamination of this mountain stream due to the insanitary conditions existing at this house near its source. It was, therefore, recommended:

1. That the board of water commissioners make frequent and regular inspection of the watersheds tributary to the public water supply of the village.
2. That the privy and barnyard on the stream tributary to the larger reservoir be removed to a safe distance from the water.
3. That should any difficulty be experienced by the water commissioners in protecting the public water supply of the village they apply to this Department for the sanitary protection of the supply.

It would appear from the report of Dr. Berry that recommendation No. 1 has been carried out, that recommendation No. 2 has been carried out in part and recommendation No. 3 has not been acted upon at all.

At the time of his inspection Dr. Berry collected samples of water from both sources of the supply and the results of analyses of these samples together with others made in the past by the Division of Laboratories and Research will be found in the appended table.

These analyses show a comparatively soft water, somewhat variable in color and at times slightly turbid. The amount of organic matter present is about normal for water derived from a surface watershed. The chlorine content however is slightly above normal for this region indicating a certain amount of contamination by animal wastes. The total bacterial counts are variable and at times somewhat high. Organisms of the B. coli type are frequently present in 10 c. c. and occasionally in 1 c. c. samples indicating contamination of human or animal origin. The high bacterial counts in the samples collected by Dr. Berry are due probably to multiplication in transit resulting from the melting of the ice in the water containers.

In view of the above facts the following conclusions may be drawn:

1. That the recommendations of this Department have been largely, although not wholly, carried out by the local authorities.
2. That both sources of water supply of the village of Rosendale are comparatively free from sources of human contamination.
3. That the Shawangunk mountains supply is open to serious contamination of animal origin due to the improper location of the barnyard and animal inclosures at the southerly farm on the watershed.
4. That both supplies however, as is true of all surface supplies, are open to accidental, incidental or wilful contamination from chance visitors upon the watersheds.

I would, therefore, recommend:

1. That the local authorities continue their watchfulness and frequently inspect the sanitary conditions upon both watersheds.
2. That the barnyard on the Shawangunk watershed be removed and relocated at a safe distance from the stream to prevent contamination of the stream by drainage therefrom.
3. That in case the village officials experience any difficulty in improving conditions upon the watershed they apply to this Department for the enactment of rules and regulations for the sanitary protection of the water supply.

Respectfully submitted,

THEODORE HORTON,
Chief Engineer

ALBANY, N. Y., *September* 10, 1915

RESULTS OF WATER ANALYSES

Abbreviations used to describe odors of water: 0, none; 1, very faint; 2, faint; 3, distinct; 4, decided; 5, strong; 6, very strong; a, aromatic, d, disagreeable; e, earthy; f, fishy; g, grassy; m, musty; v, vegetable

				PHYSICAL				CHEMICAL (PARTS PER MILLION)											BACTERIOLOGICAL			
						ODOR		SOLIDS			NITROGEN AS—						HARDNESS			B. COLI TYPE + = PRESENT — = ABSENT		
Municipality	County	Source of sample	Date of collection	Color	Turbidity	Cold	Hot	Total	Loss on ignition	Mineral residue	Free ammonia	Albuminoid ammonia	Nitrites	Nitrates	Oxygen consumed	Chlorine	Total	Alkalinity	Bacteria per c.c.; gelatin 20°, 48 hours	10 c.c.	1 c.c.	1-10 c.c.
Rosendale	Ulster	Tap, low service	3/ 1/12	Tr.	Cl.	....	....	77	9	68	.020	.026	.001	0.78	0.70	2.75	35.1	31.0	30	+	—	—
Rosendale	Ulster	Tap, high service	3/ 1/12	10	5	....	....	50	11	39	.036	.084	Tr.	0.40	2.20	1.50	24.7	19.0	5,400	+	+	—
Rosendale	Ulster	Tap, public supply	10/ 4/12	5	Tr.	....	....	65	16	49	.008	.024	.001	0.74	2.70	2.75	39.0	35.0	2,700	+	+	—
Rosendale	Ulster	Tap, low service	11/ 9/12	10	Cl.	....	....	73	19	54	.018	.084	Tr.	0.70	3.00	2.25	42.9	35.0	150	+	—	—
Rosendale	Ulster	Tap, high service	11/ 9/12	20	5	....	....	73	23	50	.016	.098	Tr.	0.50	3.80	2.75	39.0	30.0	550	+	+	—
Rosendale	Ulster	Tap, low service	12/28/12	Tr.	Cl.	....	....	70	18	52	.023	.040	Tr.	0.80	1.00	2.50	40.3	34.0	300	+	—	—
Rosendale	Ulster	Tap, high service	12/28/12	10	3	....	....	61	12	49	.020	.072	.001	0.34	1.70	2.00	36.4	32.0	200	+	—	—
Rosendale	Ulster	Tap, high service	2/ 1/13	15	5	....	....	54	....	....	.012	.060	.001	0.26	2.10	1.75	33.8	26.0	250	+	—	—
Rosendale	Ulster	Tap, low service	2/ 1/13	7	Cl.	....	....	58	....	....	.008	.054	.001	0.60	1.30	2.50	40.3	34.0	40	—	—	—
Rosendale	Ulster	Tap, high service	3/15/13	10	5	....	....	58	....	....	.016	.040	Tr.	0.20	2.00	1.50	28.6	24.0	160	—	—	—
Rosendale	Ulster	Tap, low service	3/15/13	5	Cl.	....	....	73	....	....	.020	.074	.002	0.60	0.80	2.00	36.4	31.0	350	—	—	—
Rosendale	Ulster	Mixed supply	4/19/13	22	5	....	....	93	....	....	.014	.078	.001	0.50	1.70	2.50	39.0	33.0	750	—	—	—
Rosendale	Ulster	High service	6/ 6/13	18	Tr.	....	....	64	....	....	.008	.064	.001	0.12	2.70	1.50	36.4	34.0	170	+	—	—
Rosendale	Ulster	Low service	6/ 6/13	15	Tr.	....	....	76	....	....	.008	.040	.001	0.36	1.50	2.75	37.7	36.0	240	+	—	—
Rosendale	Ulster	High service	7/11/13	15	2	....	....	76	....	....	.008	.088	.001	0.08	2.50	1.50	50.0	46.0	90	—	—	—
Rosendale	Ulster	Low service	7/11/13	12	Tr.	....	....	80	....	....	.004	.046	.001	0.44	1.50	3.25	40.3	38.0	300	+	—	—
Rosendale	Ulster	High service	3/26/14	10	3	1 v.	1 v.	68	20	48	.036	.056	.001	0.36	1.70	1.50	32.5	27.0	500	+	—	—
Rosendale	Ulster	Low service	3/26/14	5	Cl.	1 v.	1 v.	79	18	61	.044	.056	.001	0.80	0.90	2.75	40.3	33.0	190	—	—	—
Rosendale	Ulster	High service	6/28/15	5	Tr.	1 v.	1 v.	69	12	57	.002	.042	.001	Tr.	2.40	1.25	50.0	43.0	2,900	1+2—	0+3—	0+3—
Rosendale	Ulster	Low service	6/28/15	5	Tr.	3 v.	2 v.	91	10	81	.002	.020	.005	0.50	1.30	2.75	50.0	49.0	2,100	1+2—	0+3—	0+3—
Rosendale	Ulster	Reservoir, high	6/28/15	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	1,600	3+0—	2+1—	1+2—
Rosendale	Ulster	Reservoir, low	6/28/15	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	250	2+1—	1+2—	0+3—

NOTE.— Low service supply from reservoir near village. High service supply from reservoir in Shawangunk mountains.

ROSLYN

HERMANN M. BIGGS, M.D., *State Commissioner of Health:*

An investigation of the public water supply of Roslyn, Long Island was made by Mr. C. M. Baker, assistant engineer, on May 17, 1915.

Roslyn is located in the county of Nassau on the Oyster Bay branch of the Long Island railroad about 34 miles from New York City. It is situated at the head of Hempstead harbor. The population is about 3,000.

The supply is owned by the village and consists of several flowing wells from which the water is pumped into a standpipe, whence it flows by gravity through the mains to the consumers. The plant is located in the north edge of the village and along the west shore of Hempstead harbor, near its head. About 40 per cent. or 1,200 of the population are served with the water. There are in all 220 service taps all of which are metered. The water consumption is estimated at about 120,000 gallons daily, which corresponds to 100 gallons per capita per day. Due to the variation in the contour of the village, the pressure varies from about 40 to 125 pounds.

There are three 8-inch wells driven to a depth of 255 feet. As mentioned above, these wells are flowing, the static pressure when the pumps are not in operation, being about 5 pounds and the pressure gauge in the pumping station indicated at the time of the inspection that even during pumping a pressure is maintained on the pumps rather than a vacuum. The strata through which the wells pass are as follows: gravel, 15 feet; water-bearing gravel, 15 to 27 feet; quick sand, 27 feet to 208 feet; clay and sand, 208 to 213 feet; and 213 to 255 feet, a water-bearing gravel from which the supply is derived. Two Smith-Vale pumps, each with a capacity of approximately 1,000,000 gallons per day, force the water from the pumps to the standpipe which is located on a hill about a mile from the pumping station. The standpipe is at an elevation of 250 to 280 feet above the level of the main street of the village. Its capacity is 140,000 gallons. From the standpipe, the water is distributed through the village by about 14 miles of mains, ranging in size from 4 to 10 inches in diameter.

The density of population on the area tributary to the wells and within a radius of one quarter of a mile of the wells is equivalent to 1,000 people per square mile and within a radius of one-half mile, to 500 per square mile. Outside of this area and within the probable limits of the area of influence, the population is considerably less, being approximately 65 per square mile. The sewage of the village and surrounding country is principally disposed of by means of cesspools and privies, however it is apparent from the inspection that there is little opportunity for direct pollution of the ground water in the vicinity of the wells. The sewage from the toilet in the pumping plant is discharged without treatment into Hempstead harbor. There are no other residents or buildings within a distance of 300 or 400 feet from the plant.

A sample of the water was collected from a tap at the pumping station and sent to the Division of Laboratories and Research for analysis, the results being as follows:

REPORT OF WATER ANALYSIS FOR ROSLYN

Source		Tap at pumping station
Collected on		May 17, 1915
Color		Trace
Turbidity		Clear
Odor, cold		1 vegetable
Odor, hot		1 vegetable
Solids, total		40
Loss on ignition		16
Mineral residue		24
Ammonia, free		.002
Ammonia, albuminoid		Trace
Nitrites		Trace
Nitrates		.36
Oxygen consumed		0.50
Chlorine		4.25
Hardness, total		18.20
Alkalinity		10.00
Bacteria per c.c		10
B. coli type	10 c.c.	0+3—
	1 c.c.	0+3—
	1/10 c.c.	0+3—

The results of the analyses show that at the time of the inspection the water was of a satisfactory physical quality in respect to color, turbidity, and odor; also that the amount of nitrogenous matter in the form of free and albuminoid ammonia and nitrites was low. The figure of .36 for nitrates and of 4.25 for chlorine, however, was possibly somewhat above the normal. The bacterial content of 10 per c. c. was low and the B. coli type were not found present. These analyses would thus indicate a water satisfactory in quality for potable purposes.

It should be pointed out, however, that it is difficult to judge the character of a water correctly from a single analysis since, under different hydraulic conditions of the ground water caused by seasonal variation and excessive drafts on the wells at times of maximum consumption; and often resulting in much greater velocities of the ground water flow; it is possible that the purifying effect of the soil will be ineffective in completely purifying the water. It would therefore, seem that analyses of the water should be made more frequently to detect active contamination, should it exist at any time.

It is apparent from this investigation that the public water supply of Rosyln was in a satisfactory condition at the time of the inspection and also that it is at the present time satisfactorily protected from pollution in the immediate vicinity of the wells. There is, however, a comparatively dense population within a quarter of a mile of the wells and it is possible that in time and under certain conditions the pollution from this population may affect the supply.

In view of these facts, I beg to recommend:

1. That the officials in control of the water supply maintain the present satisfactory conditions in the vicinity of the wells regarding sources of pollution.
2. That the officials in charge of the water supply have frequent analyses of the water made to detect the existence at any time of active contamination.
3. That, should the analyses show at any time active contamination, steps be taken immediately to determine and eliminate if possible the sources of pollution causing such contamination.
4. Should it be found impracticable to remove any source of pollution which may occur in the future that
   (a) Some method of purification of the supply such as by chlorination be adopted.
   (b) New wells be developed at a location which will be free from contamination.

Respectfully submitted,

THEODORE HORTON,
Chief Engineer

ALBANY, N. Y., *June* 28, 1915

ROUSES POINT

HERMANN M. BIGGS, M.D., *State Commissioner of Health:*

A reinspection of the public water supply of the village of Rouses Point was made by Dr. J. A. Smith, sanitary supervisor of District A, on October 7, 1914. Previous investigations of this water supply had been made by the engineering division in 1910 and 1911, full reports of which will be found on page 576 of the thirty-first annual report of this Department and page 663 of the thirty-second annual report.

The water supply of Rouses Point is derived by pumping from Lake Champlain at a point opposite the village, the intake pipe extending some 1,200 feet into the lake. The waterworks system in general remains practically the same as described in detail in the 1910 report, and the apparatus for the sterilization of the supply is the same as described in the 1911 report.

The present population of the village is about 2,000 and the daily water consumption is estimated at 325,000 gallons. The water works are owned and operated by the village.

The water of the lake in the vicinity of the intake is open to contamination at times of heavy rainfall from the sewers of the village itself. Such contamination resulted in an outbreak of typhoid fever in 1910. The report on this water supply made in 1910 pointed out the dangerous possibilities for contamination and attributed the prevalence of typhoid in the village to such contamination. It was recommended at that time that the village authorities employ an engineer to advise and carry out such improvements as a detailed study of the conditions should find necessary to protect the supply adequately from dangerous contamination. It was further recommended that, pending permanent improvement to the supply, it be sterilized temporarily with hypochlorite of lime.

An investigation made in 1911 disclosed the fact that these recommendations had been carried out and that, under the supervision of an expert engineer, apparatus for the sterilization of the supply with hypochlorite had been installed. The conclusions of this second report were that the sterilization apparatus was according to good practice and design and, at the time of the inspection, was being carefully and efficiently operated. It was, however, recommended:

1. That pending the installation of permanent purification works, strict supervision be maintained by the board of trustees of the village over the sterilization plant to insure that all the water supply of the village should receive, at all times, a proper amount of oxidizing agent applied in such a manner as to be thoroughly distributed through the water.
2. That a modern and permanent plant be built by the village for the filtration of the public water supply taken from Lake Champlain, if, after investigation, as pointed out by this Department in the report of March 2, 1910, it should be found to be to the best interest of health and economy to continue Lake Champlain as a source of public water supply.

According to the report of Dr. Smith, there has been some complaint in the village in respect to "white" water and taste. The "white" water was found to be due to water bubbles in the water and the taste probably due to a slight excess of hypochlorite, owing to the application of about twice the amount of bleach formerly used.

Samples were taken by Dr. Smith of both raw and treated water and the results of the analyses of these samples together with others made in the past by the Division of Laboratories and Research will be found in the appended table. The results of the analyses of the samples taken by Dr. Smith are somewhat at variance, possibly due to the interruption of the pumping and hypochlorite treatment, which was found to be necessary in order to collect the sample of raw water. It should be noted, however, that several analyses of samples taken since the installation of the hypochlorite plant show rather high numbers of bacteria and the occasional presence of organisms of the B. coli type in samples as small as one cubic centimeter.

It should be noted, as pointed out in the earlier reports, that sterilization can be relied upon as a temporary measure only. In view of the dangerous sanitary quality of the raw water from Lake Champlain, purification by a modern filtration plant in conjunction with sterilization must be considered as affording the only adequate protection to the water supply of Rouses Point. This conclusion is clearly borne out by the analytical results which show that the sterilization of this water supply is not at all times sufficiently effective.

I would therefore recommend that the village authorities consider at once the installation of a modern and effective filtration plant, supplemented by the use of chlorine gas for final sterilization. Furthermore, it is essential that, pending the installation of such a filtration plant, an apparatus for the sterilization of the supply with chlorine gas be substituted for the present inefficient hypochlorite plant.

Respectfully submitted,

THEODORE HORTON,
Chief Engineer

ALBANY, N. Y., *June 5, 1915*

RESULTS OF WATER ANALYSES

Abbreviations used to describe odors of water: 0, none; 1, very faint; 2, faint; 3, distinct; 4, decided; 5, strong; 6, very strong; a, aromatic, d, disagreeable; e, earthy; f, fishy; g, grassy; m, musty; v, vegetable

Municipality	County	Source of sample	Date of collection	Physical				Chemical (Parts Per Million)												Bacteriological			
						Odor		Solids			Nitrogen as—						Hardness			Bacteria per c.c.; gelatin 20°, 48 hours	B. Coli Type + = present — = absent		
				Color	Turbidity	Cold	Hot	Total	Loss on ignition	Mineral residue	Free ammonia	Albuminoid ammonia	Nitrites	Nitrates	Oxygen consumed	Chlorine	Total	Alkalinity		10 c.c.	1 c.c.	1-10 c.c.
Rouses Point	Clinton	Tap, public supply	3/ 9/11	2	2	....	....	67	11	56	.038	.092	.003	0.20	3.80	2.00	52.9	46.0	70	—	—	—
Rouses Point	Clinton	Tap, public supply	3/ 9/11	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	60	+	—	—
Rouses Point	Clinton	Tap, public supply	10/ 5/11	10	30	....	....	100	17	83	.020	.202	.002	Tr.	2.10	1.25	47.1	46.0	70	+	—	—
Rouses Point	Clinton	Tap, public supply	1/ 1/12	10	5	....	....	89	16	73	.022	.070	Tr.	0.20	2.90	1.75	47.1	43.0	60	—	—	—
Rouses Point	Clinton	Tap, public supply	3/14/12	5	Cl.	....	....	60	16	44	.070	.074	Tr.	0.26	3.10	2.25	42.9	43.0	20	—	—	—
Rouses Point	Clinton	Tap, public supply	2/ 8/12	15	Cl.	....	....	74	7	67	.046	.086	Tr.	0.26	3.70	1.25	45.7	44.0	60	—	—	—
Rouses Point	Clinton	Tap, public supply	4/17/12	18	Tr.	....	....	94	16	78	.016	.084	Tr.	0.16	4.50	1.75	48.6	36.0	200	—	—	—
Rouses Point	Clinton	Tap, public supply	9/ 5/12	12	Cl.	....	....	82	22	60	.008	.068	.001	0.10	3.20	1.75	44.3	41.0	20	+	—	—
Rouses Point	Clinton	Tap, public supply	10/24/12	15	10	....	....	75	14	61	.026	.112	.001	0.20	3.00	1.25	51.4	42.0	780	+	—	—
Rouses Point	Clinton	Tap, public supply	12/ 5/12	15	5	....	....	85	17	68	.008	.096	.001	0.20	4.60	1.25	47.1	41.0	100	+	—	—
Rouses Point	Clinton	Tap, public supply	1/ 8/13	15	Cl.	....	....	75	....	....	.030	.078	.001	0.16	3.40	1.37	42.9	40.0	30	—	—	—
Rouses Point	Clinton	Tap, public supply	2/12/13	15	Cl.	....	....	66	....	....	.022	.060	Tr.	0.26	4.00	1.75	50.0	41.0	40	+	+	—
Rouses Point	Clinton	Tap, public supply	3/26/13	10	2	....	....	81	....	....	.016	.086	Tr.	0.16	3.80	1.25	40.3	35.0	1,100	—	—	—
Rouses Point	Clinton	Tap, public supply	5/ 7/13	15	Tr.	....	....	76	....	....	.012	.094	.001	0.12	3.40	0.87	39.0	33.0	130	+	+	—
Rouses Point	Clinton	Tap, public supply	6/18/13	12	2	....	....	69	....	....	.004	.054	Tr.	0.14	3.40	1.25	40.3	38.0	20	+	—	—
Rouses Point	Clinton	Tap, public supply	7/23/13	Tr.	Cl.	....	....	79	....	....	.004	.074	Tr.	0.10	2.50	1.00	45.7	40.0	20	+	+	—
Rouses Point	Clinton	Tap, public supply	5/12/13	10	2	1 v.	1 v.	66	17	49	.004	.070	.001	0.14	4.00	1.25	39.0	37.0	100	3+0—	0+3—	0+3—
Rouses Point	Clinton	Lake Champlain, raw water	10/ 7/14	7	2	1 v.	1 v.	98	25	73	.012	.066	.001	0.06	4.40	1.13	67.1	43.0	2,100	3+0—	1+2—	0+3—
Rouses Point	Clinton	Tap in pumping station	10/ 7/14	7	2	1 v.	1 v.	100	23	77	.012	.064	.001	0.06	4.10	0.88	70.0	45.0	2,600	3+0—	0+3—	0+3—
Rouses Point	Clinton	Tap in Mr. Coat's house	10/ 7/14	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	7,600	1+2—	1+2—	0+3—
Rouses Point	Clinton	Tap in High school	10/ 7/14	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	4,700	3+0—	0+3—	0+3—
Rouses Point	Clinton	Tap in St. Patrick's shcool	10/ 7/14	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	45	0+3—	0+3—	0+3—

SAG HARBOR

HERMANN M. BIGGS, M.D., *State Commissioner of Health:*

A reinspection of the public water supply of Sag Harbor was made on October 9, 1914, by Dr. Frank Overton, sanitary supervisor of District "S," and the following facts are based largely upon information furnished by him. A full investigation of this supply was previously made by the engineering division in September, 1909, and the report of this investigation will be found on page 318 of volume II of the thirtieth annual report of this Department.

The water supply of this village is derived by pumping from three driven wells located in the southern part of the village. The waterworks are owned and operated by the Sag Harbor Water Company. The present population of the village is about 3,500 and the daily water consumption is approximately 250,000 gallons.

At the time of the previous inspection the water supply was taken from a small brook with a watershed of about 1½ square miles. In the report of this earlier inspection it was pointed out that certain opportunities for pollution of the water supply existed upon this watershed. Reference was also made to the unsatisfactory esthetic quality of the water due to tastes and odors. It was therefore recommended that steps be taken to improve the supply and the methods for such improvements were outlined.

It appears, however, that instead of carrying out these improvements the surface supply was abandoned and replaced by the ground water supply about three years ago. At that time the three wells were sunk to a depth of 200 feet near the pumping station. A fourth well was being driven at the time of the reinspection in October, 1914. These wells are sunk in sandy soil and there are apparently no sources of contamination in their vicinity.

Wells sunk in 1868 by the water company were soon after abandoned on account of the occurrence of an excess of iron in the water obtained. It is stated that the present supply also seems to contain rather large amounts of iron which in time may give trouble.

A sample of the public supply was collected by Dr. Overton, the analysis of which will be found in the accompanying table.

A single analysis can show only the character of the water at the time of the collection of the sample and cannot with certainty indicate the quality of the water at all times and under all conditions. In the present instance the analysis shows a water rather high in color, slightly turbid and moderately hard. The figures for nitrogen in its various forms are low, with the exception of that as free ammonia. The figure for oxygen consumed is somewhat high for a ground water but this may be due to the occurrence of iron. The chlorine content is high but this is probably due to the proximity of this supply to the Atlantic ocean. The bacterial count is low and the absence of organisms of the B. coli type in all inoculations indicates freedom of this particular sample from contamination of animal origin.

In view of the above the following conclusions may be drawn:

1. That the present water supply of Sag Harobr seems to be of a reasonably satisfactory quality from the standpoint of freedom from possible contamination.
2. That, in view of the trouble experienced in the past with an excess of iron in the ground water of this vicinity, there is some probability of further trouble from a similar cause in the supply from the present wells.

I would therefore recommend:

1. That the water company continue to guard against any possible contamination of their present supply.
2. That, in case an excess of iron in the water should cause trouble, the water company make a study into the possibility of correcting such trouble by means of a properly designed and operated plant for the removal of such iron.

Respectfully submitted,
THEODORE HORTON,
Chief Engineer

ALBANY, N. Y., *January 9, 1915.*

REPORT OF WATER ANALYSIS FOR SAG HARBOR

Source		Tap at pumping station public supply
Collected on		12/16 14
Color		25
Turbidity		5
Odor, cold		1 v.
Odor, hot		1 v.
Solids, total		74
Loss on ignition		16
Mineral residue		58
Ammonia, free		.062
Ammonia, albuminoid		.010
Nitrites		.001
Nitrates		.002
Oxygen consumed		1.30
Chlorine		7.50
Hardness, total		29.9
Alkalinity		28.0
Bacteria per c.c		10
B. coli type	10 c.c.	0+3—
	1 c.c.	0+3—
	1/10 c.c.	0+3—

Results are expressed in parts per million. + Present. — Absent.
Abbreviations used to describe odors of water: 0, none; 1, very faint; 2, faint; 3, distinct; 4 decided; 5, strong; 6, very strong; a, aromatic; d, disagreeable; e, earthy; f, fishy; g, grassy; m, musty; v, vegetable.

ST. JOHNSVILLE

HERMANN M. BIGGS, M.D., *State Commissioner of Health:*

A reinvestigation of the public water supply of St. Johnsville was made following the request of Dr. C. P. Wagner, health officer of the village of St. Johnsville, in a letter under date of August 23, 1915, in which he stated that a great many complaints were then being made regarding the water.

A full investigation was made of this supply by the engineering division in August, 1911, the report thereon being published on page 763 of the thirty-second annual report of this Department. In September, 1912, another investigation was made by the engineering division (page 604, thirty-third annual report) and a still earlier inspection in connection with an outbreak of typhoid fever was made by the Department in April, 1907 (page 397, twenty-eighth annual report). A reinvestigation of the supply was made in November, 1914, by Dr. James S. Walton, sanitary supervisor of District "J." A report based principally upon information furnished by Dr. Walton was made by the engineering division under date of January 30, 1915. Copies of this report were transmitted to Dr. James S. Walton, sanitary supervisor, to the board of water commissioners of St. Johnsville and to Dr. C. P. Wagner, health officer of St. Johnsville. This report concluded that the supply was then in satisfactory sanitary condition.

The supply at the time of the recent investigation was practically the same as at the time of the investigation by Dr. Walton and as it was described in considerable detail in the report then submitted, the present report will deal principally with additional information or corrections.

The water supply is derived from springs located near the hamlet of Lassellsville about six miles northeast of St. Johnsville. At this place the water is collected into a small reservoir whence it flows by gravity to concrete storage reservoirs located near the village. From these reservoirs the water flows by gravity to the consumers.

The collecting reservoir at the intake has a capacity of about 10,000 gallons. It had not been cleaned for about two years prior to the time of the inspection because of construction work which had been in progress in con-

nection with the storage reservoirs, making it impossible or at least imprac- ... n this reservoir during this period. At the time of this investi- ... erable sediment had collected in it in the form of black humus ... t."

... orage reservoirs, two in number, have a total capacity of a little o... 0,000 gallons, one holding something over and the other a little l... 1,000,000 gallons. One of these reservoirs is of recent construction ... other has been recently repaired and enlarged. These reservoirs ... th cleaned during the past summer but considerable sediment, which ... in color and resembles very much the "wood dirt" noticed in the ... ing reservoir, had collected in the bottom of them.

... previous report stated that the connection with Zimmerman brook had ... removed. It was learned in connection with this investigation, however, ... such was not the case but that there are two halves on this line which ... kept closed. It is thus possible to use water from this source in case necessity should require it. As pointed out in previous reports, the supply from Zimmerman creek is very highly polluted and in case it should be introduced into the system would contaminate the supply and possibly cause disease among the inhabitants using the water.

Inquiry regarding the complaints which have been made in respect to the supply indicated that the objections offered were due to odors, which have been noticed in cases where cloth has been tied over the faucet to act as a strainer and that the odors were not generally noticed throughout the village. In fact in all cases where the assistant engineer was informed that disagreeable odors had existed, strainers were used on the faucets. The assistant engineer was informed that at times when the hydrants are flushed, considerable black material is noticed resembling very much the "wood dirt" which accumulates in the collecting reservoir. It is thus apparent that considerable of this material which is very light and settles out slowly in the reservoir, finds its way into the mains. When collected in strainers placed over the faucets and allowed to stand this material doubtless decomposes and causes offensive odors.

Various samples of the water were collected and sent to the Division of Laboratories and Research for analyses, the results of which are as follows:

REPORT OF WATER ANALYSIS FOR ST. JOHNSVILLE

Source		Tap, main supply	Collecting gallery	Tap, spring near town
Collected on		9/17/15	9/17/15	9/17/15
Color		3	....	....
Odor, hot		2 v.	....	....
Odor, cold		2 v.	....	....
Turbidity		1	....	....
Solids, total		183	....	....
Loss on ignition		20	....	....
Mineral residue		163	....	....
Ammonia, free		.004	....	....
Ammonia, albuminoid		.014	....	....
Nitrites		.002	....	....
Nitrates		0.10	....	....
Oxygen consumed		3.20	....	....
Chlorine		1.00	....	....
Hardness, total		120.00	....	....
Alkalinity		117.00	....	....
Bacteria per c.c		160	1,000	250
B. coli type	10 c.c.	1+2—	3+0—	1+2—
	1 c.c.	0+3—	1+2—	0+3—
	1/10 c.c.	0+3—	0+3—	0+3—

Previous analyses were discussed in the report on the investigation made by Dr. Walton and will, therefore, not be taken up in this report. The results of the analyses made at the time of the present investigation show that the water collected from a tap in the village contained only a moderate

amount of organic matter and 160 bacteria per c.c. The B. coli type were found present in one of the 10 c.c. inoculations. This, however, is probably due to surface wash from the land in the vicinity of the springs since there had been heavy rains just prior to the time of collecting the sample. Bacterial analyses of the sample collected from the collecting gallery just above the collecting reservoir showed the presence of 1,000 bacteria per c.c. with the B. coli type present in all three of the 10 c.c. inoculations and in one of the three 1 c.c. inoculations. These results are higher than would be expected from a spring supply but are also probably due to surface wash.

The sample collected from the spring located near the village which supplies several houses was found to contain 250 bacteria with the B. coli type present in only one of the 10 c.c. inoculations. This spring is apparently satisfactorily protected from possible pollution and although the bacterial content was somewhat high and B. coli were found present to some extent, these results are probably due to the heavy rains just prior to the time of collecting the samples.

Samples of water were also collected and examined for algae growths and although several species of algae were found present, none predominated and the number of algae were apparently insufficient to cause any unsatisfactory results at the time of the inspection.

As a result of this investigation, I beg to offer the following conclusions:

1. That there appears to be little, if any, opportunity for the water supply of St. Johnsville to receive under normal conditions, pollution of a dangerous character and that at the time of the inspection the water was apparently in a satisfactory sanitary condition.

2. That the connection with Zimmerman creek has not been eliminated but that this supply is shut off from the main supply by the closing of two gate valves.

3. That considerable sediment in the form of sand and "wood dirt" has accumulated in the collecting reservoir because of infrequent cleanings and that similar sediment has at times collected to some extent in the mains.

4. That the odors which have been the cause of complaints regarding the water have probably been due to the accumulation of humus or "wood dirt" from the reservoirs in the cloths trainers placed over the faucets in numerous instances.

In view of the above, the following recommendations to be acted upon by the water commissioners may be made:

1. That the connection with Zimmerman creek which now exists be removed.

2. That the reservoirs be regularly cleaned and the mains flushed at sufficiently frequent intervals to prevent the accumulation of large amounts of sediment.

3. That the citizens be advised to remove all strainers from their faucets since they accumulate sediment which may undergo putrefaction and cause disagreeable tastes and odors.

It seems probable that if recommendation No. 2 is carried out, that is, if the reservoirs are kept properly cleaned at all times and the mains flushed, very little, if any, trouble should be experienced from sediment in the distribution system. In this case there should be no necessity for the citizens to provide strainers on their faucets.

I believe that with these recommended improvements and proper supervision of the supply at all times, a pure and wholesome water supply can be obtained for the village of St. Johnsville.

Respectfully submitted,

THEODORE HORTON,
Chief Engineer

ALBANY, N. Y., *November 5, 1915*

ST. JOHNSVILLE

HERMANN M. BIGGS, M.D., *State Commissioner of Health:*

A reinspection of the public water supply of St. Johnsville was made by Dr. James S. Walton, sanitary supervisor of district "J," in November, 1914, and the following report is based largely upon information furnished by him.

A full investigation of this supply was made by the engineering division in August, 1911, and the report of this investigation will be found on page 763 of the thirty-second annual report of this Department. In September, 1912, another investigation of the supply was made by the engineering division (see thirty-third annual report, page 604). A still earlier inspection in connection with an outbreak of typhoid fever was made by the Department in April, 1907 (see twenty-eighth annual report, Vol. 1, page 397).

The water supply of this village is derived from a series of springs located near the hamlet of Lassellsville, about six miles northeast of the village. The methods of collection and distribution of the water remain practically the same as described in the report of 1911. A new concrete distribution reservoir with a capacity of about 1,000,000 gallons has been constructed alongside the old reservoir and the older reservoir has had its walls extended three feet in height thereby increasing its capacity to 500,000 gallons, the total storage capacity now being 1,500,000 gallons. The new reservoir has been in service since the middle of November, 1914, and the old reservoir has been out of service in order that it may be made water-tight. It is planned to operate both reservoirs so as to obtain full storage capacity and also that one reservoir may be in service when it becomes necessary to clean either. The daily water consumption is approximately 200,000 gallons and the population of the village about 3,000.

The watershed of the springs is a small steep hillside of a few acres in area. This area is owned by the village and no sources of contamination exist at present. The outbreak of typhoid in 1907 was ascribed to the infection of the spring supply from the privy of a single house upon the watershed near the collecting basin of the springs. This house was later purchased by the village and destroyed.

Formerly the old distribution reservoir was connected with Zimmerman creek in order that water from that source might be used in case of emergency or at times of shortage of the spring supply. Since the construction of the new reservoir and the increase in storage capacity this connection has been removed.

The report of the investigation of 1911 pointed out that the Lassellsville springs furnished a supply of satisfactory quality although somewhat inadequate in quantity. Warning, however, was given against the use of impure and unsafe water from Zimmerman creek and it was recommended that the creek be abandoned as a source of supply or else subjected to some form of water purification. Furthermore it was recommended that the question of securing an adequate and satisfactory water supply be studied by an expert engineer in order that the most advantageous solution of the problem might be found.

At the time of the subsequent inspection in 1912 it was found that the village authorities had employed an engineer by whom a careful study of the water supply problem had been carried out and by whom a report had been submitted, containing several recommendations for improvements. It was also found that several of these recommendations had been acted upon but that need still existed for the carrying out of the other recommendations. This Department therefore recommended that all the recommendations of the engineer employed by the village be carried out, that the walls of the distribution reservoir be extended to such a height as to exclude all surface wash and that the emergency supply from the creek be controlled in such a way as to preclude the possibility of the creek water entering the reservoir at times other than emergency, an earlier recommendation having been made that Zimmerman creek be abandoned as a source of supply or properly purified.

It appears that from the data furnished by Dr. Walton that the village officials have acted in accordance with the recommendations of this Department in constructing additional storage capacity for the conservation of the spring supply, in raising the walls of the old reservoir and in abandoning the use of Zimmerman creek.

At the time of his inspection Dr. Walton collected samples of the village supply and the results of the analysis of these samples, together with others made in the past by the Division of Laboratories and Research will be found in the appended table.

Although unsatisfactory results have been obtained at times in the past such results were undoubtedly due to either a mixture of creek water with the spring water or contamination by surface wash. The sample collected by Dr. Walton is probably representative of the spring water supply and the analysis indicates a reasonably satisfactory quality, being low in total bacteria and free from B. coli in an inoculation as large as 30 cubic centimeters.

In view of the foregoing facts the following conclusions may be drawn:

1. That the village authorities have apparently carried out all the recommendations of this Department.
2. That the present water supply if carefully protected from all possible sources of contamination should furnish a satisfactory quality of water.

In view of the present condition of the water supply it does not appear that any further recommendation for improvement may be made except to emphasize the importance of careful supervision on the part of the village authorities to prevent any possible contamination of the supply.

Respectfully submitted,

THEODORE HORTON,

Chief Engineer

ALBANY, N. Y., *January* 30, 1915

RESULTS OF WATER ANALYSES

Abbreviations used to describe odors of water: 0, none; 1, very faint; 2, faint; 3, distinct; 4, decided; 5, strong; 6, very strong; a, aromatic; d, disagreeable; e, earthy; f, fishy; g, grassy; m, musty; v, vegetable

Municipality	County	Source of sample	Date of collection	PHYSICAL				CHEMICAL (PARTS PER MILLION)											BACTERIOLOGICAL			
						ODOR		SOLIDS			NITROGEN AS—						HARDNESS			B. COLI TYPE + = PRESENT — = ABSENT		
				Color	Turbidity	Cold	Hot	Total	Loss on ignition	Mineral residue	Free ammonia	Albuminoid ammonia	Nitrites	Nitrates	Oxygen consumed	Chlorine	Total	Alkalinity	Bacteria per c.c.; gelatin 20°, 48 hours	10 c.c.	1 c.c.	1-10 c.c.
St. Johnsville..	Montgomery...	Tap, public supply..........	9/29/11	Tr.	Cl.	....	....	126	17	109	.006	.024	.001	0.10	0.28	1.25	108.6	0.28	130	+	+	—
St. Johnsville..	Montgomery...	Tap, public supply..........	11/28/11	1	Cl.	....	....	130	19	111	.008	.046	.001	0.12	1.30	0.75	108.6	1.30	60	—	—	—
St. Johnsville..	Montgomery...	Tap, public supply..........	12/19/11	5	Cl.	....	....	115	11	104	.008	.012	.001	0.26	1.00	1.25	101.5	1.00	70	3+0—	0+3—	0+3—
St. Johnsville..	Montgomery...	Tap, public supply..........	2/ 2/12	Tr.	Cl.	....	....	123	22	101	.026	.048	Tr.	0.34	1.30	0.50	84.3	......	210	3+0—	3+0—	0+3—
St. Johnsville..	Montgomery...	Tap, public supply..........	3/14/12	5	Cl.	....	....	103	8	95	.020	.048	.001	0.40	1.50	0.25	85.7	......	2,000	3+0—	1+0—	0+3—
St. Johnsville..	Montgomrey...	Tap, public supply..........	5/22/12	1	Cl.	....	....	129	16	113	.004	.026	Tr.	0.24	0.90	0.50	102.8	98.0	40	0+3—	0+3—	0+3—
St. Johnsville..	Montgomery...	Tap, public supply..........	6/20/12	Tr.	5	....	....	139	21	118	.002	.042	.001	0.26	0.80	0.50	105.8	100.0	140	3+0—	0+3—	0+3—
St. Johnsville..	Montgomery...	Tap, public supply..........	9/11/12	15	Tr.	....	....	134	11	123	.002	.026	Tr.	0.24	2.20	0.25	108.6	102.0	*8,500	3+0—	3+0—	2+1—
St. Johnsville..	Montgomery...	Spring at Lassellsville.......	10/ 1/12	5	Tr.	....	....	130	20	110	.002	.028	.001	0.26	1.60	0.75	97.2	95.0	250	1+2—	0+3—	0+3—
St. Johnsville..	Montgomery...	Tap, public supply..........	10/ 1/12	10	Tr.	....	....	145	20	125	.004	.032	.001	0.18	3.30	0.75	97.2	92.0	140	1+2—	0+3—	0+3—
St. Johnsville..	Montgomery...	Reservoir, public supply.....	10/ 1/12	5	Tr.	1 v.	1 v.	120	10	110	.004	.042	.001	0.14	1.40	0.75	100.0	96.0	270	0+3—	0+3—	0+3—
St. Johnsville..	Montgomery...	Old spring supply............	10/ 1/12	....	....	....	....	....	....	....	....	....	....	....	....	......	......	......	110	1+2—	0+3—	0+3—
St. Johnsville..	Montgomery...	Tap, public supply..........	1/31/13	Tr.	Cl.	1 v.	1 v.	124	....	....	.020	.036	.001	0.22	1.30	0.75	105.8	104.0	80	0+3—	0+3—	0+3—
St. Johnsville..	Montgomery...	Tap, public supply..........	4/16/13	Tr.	Cl.	1 v.	1 v.	130	....	....	.012	.016	.001	0.12	1.20	1.00	117.2	106.0	40	0+3—	0+3—	0+3—
St. Johnsville..	Montgomery...	Tap, public supply..........	5/ 8/13	2	Cl.	1 v.	1 v.	117	....	....	.002	.014	Tr.	0.16	0.20	0.75	102.8	101.0	40	3+0—	0+3—	0+3—
St. Johnsville..	Montgomery...	Tap, public supply..........	11/27/13	5	2	1 v.	1 v.	125	13	112	.008	.046	.001	0.20	6.10	0.75	111.4	100.0	120	0+3—	0+3—	0+3—

* Thirty-six hours in transit. Ice melted.

ST. REGIS FALLS

HERMANN M. BIGGS, M.D., *State Commissioner of Health:*

An investigation of the public water supply of the village of St. Regis Falls, was made August 11, 1915, by Mr. E. S. Chase, assistant engineer in this Department. The assistant engineer was accompanied and aided on this inspection by Mr. H. E. O'Neil and Dr. W. A. Wardner, health officer.

St. Regis Falls is an incorporated village with a population of about 1,500 located near the western boundary of Franklin county, about 25 miles from the Canadian border. The Ottawa branch of the New York Central R. R. connects the village with the Adirondack division of the railroad.

The village is a center for a lumber district and contains one large factory of the Brooklyn Cooperage Co. There is no public sewer system and the village is served by privies, cesspools and a few private sewers.

The water supply of the village is derived from springs located in the hills about two miles south of the village. The water from these springs is collected in a small open reservoir approximately 40 x 60 feet in plan by 8 feet deep with a capacity of about 175,000 gallons. From this reservoir the water is distributed by gravity through about 2½ miles of water mains ranging in size from 2 inches to 3 inches in diameter. Twenty-five per cent only of the population is supplied by the water and the daily consumption is unknown. This summer an attempt has been made to develop an additional supply from wells in the western part of the village. To date only one well has been constructed but the development of the others is pending the result and conclusions of this investigation. The waterworks are owned by Mrs. W. T. O'Neil and are operated under the direction of her son, Mr. H. E. O'Neil.

There are two springs located about ¼ mile south of the reservoir. The spring water is collected as it issues from the ground and is carried by a 3-inch pipe line to the reservoir. In addition to the spring water a small amount of surface water is also collected. The lower spring issues from a gravel bank, flows into a small depression, which at one time was a small reservoir, and then through a strainer into the pipe leading to the reservoir. The water from the upper spring is collected in a small pit with timber framework. This basin receives a certain amount of water from a small brook which flows adjacent to it. Above these springs there is a surface watershed of perhaps ½ square mile. This area consists of side hills with moderate slopes covered with underbrush and second growth hardwood. In the valley between the side hills there are small swamps. The soil is sand and gravel mixed with granite boulders overlying rock strata of granite. Practically this entire watershed is owned by the O'Neils. There are no habitations upon this area nor is any of it devoted to pasturage. The only possible contamination is that which might be derived from chance visitors upon the watershed. During the summertime this watershed is probably visited by numerous berry pickers.

The new well in the village, constructed this summer, is 12 feet deep and about 2 feet in diameter. The first 8 feet of the well were dug through soil consisting of sand mixed with boulders, the remaining 4 feet being through granite rock. The water from this well is pumped directly into the distribution system by a small duplex Deane pump geared to a 2-horse-power General Electric induction motor.

At the time of this inspection the well was open at the top and there was some possibility of its receiving surface water at times of rainfall. The surface area tributary to this well is only about 5 to 10 acres in extent. Upon this area there are five or six houses and one creamery. The nearest house is about 300 feet distant and all the houses are at an elevation of 15 to 20 feet above the ground in the vicinity of the well. The creamery is located about 250 feet from the well at a higher elevation. Back of this creamery there is a pig sty the slope from which is rather abrupt towards the well. The wash water from the creamery is discharged into a small ditch leading away from the well.

In view of the limited surface watershed area tributary to this well it

seems very probable that the quantity of water capable of development from this source would be inadequate for the needs of the village. If, however, this well or other wells in its immediate vicinity should yield any large supply, it is evident that the ground water source would be much more extensive than that underneath the surface watershed. In this case it seems extremely probable that a large amount of the supply would be derived from the ground water underneath a much larger portion of the village than is located on the surface watershed. The supply would therefore be very liable to active contamination by the leaching from additional cesspools, privies and leaky sewers. Such contamination would be especially likely to occur in view of the increased draft upon the ground water incidental to pumping.

Another possible source of water supply, although undeveloped at present, is the St. Regis river. The river above the village flows through a comparatively unpopulated section, the population being estimated as only 2 per square mile. There are comparatively few sources of direct contamination of the stream and a great portion of the watershed is barren and undeveloped land. There are however opportunities for accidental and intermittent contamination from lumbermen and other visitors upon the watershed. The water is very soft and is very highly colored, as the stream flows in places through extensive swamps. While the water would not be suitable for domestic purposes without purification it seems very probable that sterilization alone would render it safe for drinking purposes.

At the time of the inspection, samples of water were collected and the results of the analyses of these samples will be found in the appended table.

These analyses show clearly the marked difference in the quality of the uncontaminated spring water and the water from the new well recently developed. The results of the analyses of the sample from the spring may be taken as characteristic of an uncontaminated supply for this region. Compared with these results it will be seen that the water from the new well is very much higher in organic matter, both decomposing and decomposable, and is especially high in nitrogen in its oxidized form of nitrates. These figures for nitrates taken in conjunction with the very high figures for chlorine, show clearly that the supply derived from the new well has received marked contamination by organic wastes of animal or human origin. The unsatisfactory bacterial results can be partly attributed to the fact that this well was not properly protected at the time of inspection from surface wash, although it is very probable, in view of the chemical results, that the bacterial results are also due in part to active contamination of the ground water unpurified by its passage through the soil. In this connection it should be noted that the bacterial analyses of the sample taken from the Waverly spring, located near the new well and which is probably derived from the same ground watersource, show that this water has also received a certain amount of active contamination of animal or human origin, indicated by the occurrence of fecal organisms of the B. coli type. It is extremely probable therefore that if the new well water at present, before extended pumping upon it has taken place, shows such strong evidence of contamination, this contamination will become more concentrated and dangerous under conditions of heavy draft.

In view of the above facts the following conclusions may be drawn:

1. That the present spring supply is capable of furnishing a satisfactory quality of water if properly developed and properly protected from accidental contamination.

2. That the new well and the proposed wells in its vicinity will probably yield an insufficient amount of water to supply the village.

3. That the water derived from the new well is of unsatisfactory sanitary quality at present and under conditions of greater draft it seems very probable that it will become still more seriously and actively contaminated.

4. That an additional gravity supply of satisfactory quality can doubtless be developed by the location of wells in the vicinity of the present spring supply. Owing however, to the comparatively limited watershed available it seems probable that this source could not be developed to supply the entire population of the village at all times.

5. That the St. Regis river, although unsafe to use without purification due to the numerous sources for accidental and intermittent contamination, would afford an adequate and safe supply for emergencies and reserve use if properly protected by sterilization.

I would, therefore, recommend —

1. That no further development be made of the wells located in the village and that the well already constructed be abandoned as soon as possible.

2. That the spring supply be developed more carefully and that additional wells be located in the vicinity of these springs.

3. That in order to obtain an adequate supply for use at times of drought and other emergencies, the St. Regis river be developed.

4. In case the river water is used as a source of supply the intake should be located above the village and all water used should be sterilized with liquid chlorine. Furthermore efforts should be made to remove, within a reasonable distance above the intake, such sources of direct contamination as may occur.

Respectfully submitted.

THEODORE HORTON,
Chief Engineer

ALBANY, N. Y., *August* 26, 1915

REPORT OF WATER ANALYSIS FOR ST. REGIS FALLS

Source		Lower spring, regular supply	New well	Waverly spring	Tap in village, mixed supply
Collected on		8/11/15	8/11/15	8/11/15	8/11/15
Color		Trace	Trace	....	....
Turbidity		Clear	3	....	....
Odor, cold		2 a.	1 v.	....	....
Odor, hot		2 a.	1 v.	....	....
Solids, total		31	93	....	....
Loss on ignition		6	48	....	....
Mineral residue		25	45	....	....
Ammonia, free		.004	.010	....	....
Ammonia, albuminoid		.006	.018	....	....
Nitrites		.001	.001	....	....
Nitrates		0.20	2.40	....	....
Oxygen consumed		0.30	1.50	....	....
Chlorine		0.50	12.0	....	....
Hardness, total		23.4	41.00	....	....
Alkalinity		19.0	5.0	....	....
Bacteria per c.c		20	1,300	60	300
B. coli type	10 c.c.	0+3—	3+0—	3+0—	3+0—
	1 c.c.	0+3—	3+0—	0+3—	2+1—
	1/10 c.c.	0+3—	1+2—	0+3—	1+2—

Results are expressed in parts per million. + Present. — Absent.

Abbreviations used to describe odors of water: 0, none; 1, very faint; 2 faint; 3, distinct; 4, decided; 5, strong; 6, very strong; a, aromatic, d, disagreeable; e, earthy; f, fishy; g, grassy; m, musty; v, vegetable.

SANDY CREEK

HERMANN M. BIGGS, M.D., *State Commissioner of Health:*

A reinspection of the public water supply of Sandy creek was made in July, 1915, by Dr. F. W. Sears, sanitary supervisor, of District "I." A previous investigation of this supply was made by the Engineering Division in 1911, a full report of which will be found on page 766 of the thirty-second annual report of this department.

The water supply of Sandy creek is derived from springs and from a small surface stream impounded in a reservoir about 2½ miles east of the village. The waterworks system remains practically the same as described in detail in the earlier report.

The watershed of the stream tributary to the reservoir has an area of one square mile and an estimated population of about 25. The various houses and farm buildings located upon this area are in most cases situated at reasonably safe distances from the stream. In a few instances, however, there are farm buildings and barn yards in close proximity to the watercourses and these points at which contamination could easily reach the stream were specifically pointed out in the previous report. In addition to contamination from permanent sources there is also the ever present possibility of accidental or wilful contamination incidental to a populated watershed.

The previous report reached the conclusion that the water supply of Sandy Creek received a certain amount of objectionable pollution from the fertilizing of fields adjacent to watercourses and to direct or indirect discharge of human excreta or other wastes into the streams.

It was, therefore, recommended:

1. That the Board of Water Commissioners take the necessary steps to have the pollution above referred to removed from the water supply;

   (a) By preventing so far as possible the fertilizing of fields adjacent to all watercourses and in seeing that no manure used for fertilizing purposes is allowed to become contaminated in any way by human excreta or other wastes.

   (b) By having all privies, cesspools, drains and other receptacles of human excreta or other wastes kept a safe distance away from all streams and that they be so constructed and maintained that no direct contamination from such sources can reach the water supply.

2. That should any difficulty be experienced in abating the conditions or carrying out the measures referred to, the board of water commissioners apply to this Department for the enactment of rules and regulations for the sanitary protection of the watershed of their supply in accordance with the provisions of section 70 of the Public Health Law.

From the report of Dr. Clark it appears that the need for these recommendations still exists.

The results of the analysis of samples of this water supply made in the past by the Division of Laboratories and Research will be found in the appended table. These analyses show a slightly colored, at times turbid and moderately soft water. The figures for nitrogen in its various forms indicate moderately high amounts of decomposing and decomposable organic matter and are consistent with the conditions found upon the watershed. The chlorine figures are above the normal found in unpolluted water supplies of this region. The bacterial counts are high and the occurrence of organisms of the B. coli type in samples as small as one c.c. indicates active contamination of animal or human origin.

In view of the above facts the following conclusions may be drawn:

1. That the previous recommendations of this Department have apparently not been carried out by the local authorities.

2. That the water supply of Sandy Creek is subject to considerable pollution by surface wash from highways, from cultivated and manured fields, from barnyards and from the vicinity of dwellings.

I would, therefore, recommend:

1. That the village authorities give their immediate attention to the previous recommendations of this Department.

2. That in addition to removing as far as possible the permanent sources of contamination upon the watershed, the village install and operate suitable apparatus for sterilization of the supply in order to eliminate as far as possible all danger from accidental contamination by the residents upon the watershed or by transients thereto.

3. That, in case the village considers it impracticable and uneconomical to carry out the above recommendations, studies be made and steps be taken to secure a new supply, satisfactory in quality and sufficient in quantity.

Respectfully submitted,

THEODORE HORTON,
Chief Engineer

ALBANY, N. Y., *December* 13, 1915

RESULTS OF WATER ANALYSES

Abbreviations used to describe odors of water: 0, none; 1, very faint; 2, faint; 3, distinct; 4, decided; 5, strong; 6, very strong; a, aromatic, d, disagreeable; e, earthy; f, fishy; g, grassy; m, musty; v, vegetable

Municipality	County	Source of sample	Date of collection	Physical				Chemical (Parts Per Million)											Bacteriological			
						Odor		Solids			Nitrogen as—						Hardness			B. Coli Type (+ = present, — = absent)		
				Color	Turbidity	Cold	Hot	Total	Loss on ignition	Mineral residue	Free ammonia	Albuminoid ammonia	Nitrites	Nitrates	Oxygen consumed	Chlorine	Total	Alkalinity	Bacteria per c.c.; gelatin 20°, 48 hours	10 c.c.	1 c.c.	1-10 c.c.
Sandy Creek...	Oswego.......	Tap, public supply..........	2/29/12	Tr.	Cl.	....	....	55	15	40	.006	.036	Tr.	0.87	1.20	1.00	32.5	30.0	700	—	—	—
Sandy Creek...	Oswego.......	Tap, public supply..........	4/25/12	15	5	....	....	37	8	29	.002	.066	Tr.	0.26	6.00	0.75	26.0	20.0	1,200	+	+	—
Sandy Creek...	Oswego.......	Tap, public supply..........	10/30/12	5	Cl.	....	....	61	22	39	.008	.090	Tr.	0.60	2.40	1.50	36.4	33.0	400	+	+	—
Sandy Creek...	Oswego.......	Tap, public supply..........	1/13/13	5	Cl.	....	....	41	....	....	.010	.046	Tr.	0.90	0.90	1.25	28.6	18.0	1,200	+	+	+
Sandy Creek...	Oswego.......	Tap, public supply..........	2/18/13	5	Cl.	....	....	49	....	....	.016	.046	Tr.	0.70	1.20	1.00	36.4	25.0	230	+	+	—
Sandy Creek...	Oswego.......	Tap, public supply..........	4/ 1/13	5	Tr.	....	....	37	....	....	.010	.040	Tr.	0.46	1.70	1.00	24.7	16.0	250	+	—	—
Sandy Creek...	Oswego.......	Tap, public supply..........	5/13/13	Tr.	2	....	....	49	....	....	.008	.042	Tr.	0.34	0.90	1.00	32.5	28.0	120	+	—	—
Sandy Creek...	Oswego.......	Tap, public supply..........	6/24/13	....	....	....	....	94	....	....	.006	.050	.001	0.26	1.50	1.25	37.7	36.0	900	+	+	—
Sandy Creek...	Oswego.......	Tap, public supply..........	7/29/13	5	2	....	....	81	....	....	.010	.062	.001	0.30	1.90	0.75	52.9	49.0	1,400	+	+	—
Sandy Creek...	Oswego.......	Tap, public supply..........	5/ 1/14	5	Cl.	1 v.	1 v.	57	14	43	.008	.028	.001	0.36	1.30	1.25	35.1	28.0	160	+	+	—

SAUGERTIES

HERMANN M. BIGGS, M.D., *State Commissioner of Health:*

A reinspection of the public water supply of Saugerties was made on March 17, 1915, by Dr. C. W. Berry, sanitary supervisor of District "H." The following report is based largely on information furnished by him. A previous investigation of this supply was made by the engineering division in 1909, a full report of which will be found on page 321 of the thirtieth annual report of this Department.

The public water supply of Saugerties is derived from a reservoir situated about five miles northwest of the village on the Plattekill creek. The waters of this creek are impounded in a reservoir formed by a dam of stone and cement across the bed of the stream. The supply of water is abundant and at all times of the year an excess flows over the dam. The present population of the village is about 4,000 and the daily water consumption is about 500,000 gallons. There are about 15 miles of mains ranging in size from 4 to 16 inches in diameter and 689 service taps, of which 311 are metered. The water is distributed by gravity with an average pressure of 50 pounds to the square inch. The waterworks are owned and operated by the village.

In order to increase the water pressure in case of fire the village authorities have proposed to install fire pumps in one of the factories in the village. It is stated that the source of this auxiliary fire supply is seriously polluted and would be a source of contamination to the present water supply if introduced into the village mains.

Plattekill creek is formed by a number of small tributaries rising in the Catskill mountains. The watershed is approximately 17 square miles in area, about one-half consisting of the side slopes of the mountains and the other half the level valley at their base. The main stream has its source from springs in the mountains and being fed by a number of small tributaries flows through Plattekill Cove down a steep slope through the hamlet of Saugerties, and then pursues a winding course over flat land to its point of junction with a smaller stream from Sexton about two miles above the reservoir.

There are about 150 farm houses, summer hotels and dwellings on the watershed adjacent to the streams and many of them are directly on the banks. One large house and barns are located less than 100 feet from the side of the reservoir. At West Saugerties there are several houses, privy vaults, stables and chicken houses directly over the stream. The total population of the watershed is estimated at about 700 people during the winter and about 2,000 during the summer. Most of this population resides on the lower land at the foot of the mountains. In 1914 rules and regulations were enacted by this Department for the sanitary protection of this water supply and at the time of the reinspection there were about forty violations in existence. Notices have been served upon the owners of the properties harboring such violations requiring abatement. An inspector is employed who devotes his entire time to the inspection of the watershed to discover violations of the rules and bring about their abatement. The board of water commissioners proposes to construct new privy vaults, stables, etc., where needed, at the expense of the village and to keep them constantly under inspection. The farm buildings on the reservoir bank are to be acquired by condemnation proceedings. It is said that there are frequent cases of typhoid at West Saugerties which undoubtedly constitute a most serious menace to the water supply of Saugerties.

The previous report pointed out numerous possibilities for pollution as described above and arrived at the conclusion that considering the large population and the large number of cases of pollution of the watershed and owing to the fact that the Catskill mountains are year to year developing into a popular summer resort, it would be impossible to prevent the increasing amount of indirect pollution even if the direct pollution could be largely eliminated and that the purification of the water would, therefore, prove the most effective barrier against the dangers menacing the supply.

It was, therefore recommended that the Saugerties board of water commissioners be advised to take immediate steps to secure necessary and adequate protection:

1. By such action as is provided by the rules and regulations enacted by this Department for the protection of their supply and as will remove all existing sources of pollution.
2. By further protecting the supply by the installation of a modern filtration plant or some other suitable method of purification.
3. By securing the services of a competent expert to make a careful study of the problems and to advise them definitely as to the best means of providing a safe and wholesome supply of water.

It appears then that the report of Dr. Berry that the village is carrying out the recommendations in respect to improving conditions on the watershed by means of the methods provided by the rules and regulations of this Department but that no steps have been taken toward the installation of a modern purification plant.

At the time of his inspection Dr. Berry collected samples of the water from a tap in the village, from the reservoir and from Plattekill creek above West Saugerties, the analyses of which made by the Division of Laboratories and Research will be found in the appended table. These analyses show a water slightly colored, at times turbid and quite soft. The total number of bacteria is frequently excessive and organisms of the B. coli type are in the majority of cases in 10 c.c. and occasionally in quantities as small as 1 c.c. These results indicate that the supply is receiving at practically all times a certain amount of active contamination by animal or human origin and at other times this contamination becomes comparatively concentrated.

In view of the above facts the following conclusions may be drawn:

1. That the board of water commissioners is carrying out the recommendations of this Department in attempting to remove the sources of contamination existing upon the watershed, but has failed to carry out the recommendation for the installation of a modern filtration plant.
2. That while the removal of the sources of direct contamination will improve the quality of the water supply and lessen the danger of infection to the supply, such measures are inadequate to protect the supply from accidental, incidental or wilful contamination coincident with a densely populated watershed.
3. That unless some measures are taken to purify this water supply there is every reason to believe that the supply is liable to active typhoid infection, bringing about an outbreak of typhoid in the village.
4. That the introduction of an auxiliary supply for fire protection from a polluted source is open to most serious objection due to the strong possibility of contamination and even infection of the water in the village mains.

I would therefore recommend:

1. That the village authorities continue their efforts in cleaning up the watershed and removing all sources of direct contamination.
2. That the village consider at once the installation at the earliest possible moment of some modern method of water purification.
3. That, pending the installation of such a plant, the village install apparatus for the sterilization of the water supply with hypochlorite of lime or liquid chlorine.
4. That, in order to obtain a supplementary supply, if necessary, for fire protection, the village develop the present supply or obtain an additional supply from a source free from contamination.
5. That, in view of the engineering problems involved in the purification of the present supply and in the development of a supply sufficient for fire protection, the village employ, a competent sanitary engineer to make such studies and plans necessary for the carrying out of these projects.

Respectfully submitted,
THEODORE HORTON,
Chief Engineer

ALBANY, N. Y., *May* 3, 1915

RESULTS OF WATER ANALYSES

Abbreviations used to describe odors of water: 0, none; 1, very faint; 2, faint; 3, distinct; 4, decided; 5, strong; 6, very strong; a, aromatic, d, disagreeable; e, earthy; f, fishy; g, grassy; m, musty; v, vegetable

Municipality	County	Source of sample	Date of collection	Physical: Color	Physical: Turbidity	Physical: Odor: Cold	Physical: Odor: Hot	Chemical (Parts per Million): Solids: Total	Solids: Loss on ignition	Solids: Mineral residue	Nitrogen as—: Free ammonia	Nitrogen as—: Albuminoid ammonia	Nitrogen as—: Nitrites	Nitrogen as—: Nitrates	Oxygen consumed	Chlorine	Hardness: Total	Hardness: Alkalinity	Bacteriological: Bacteria per c.c.; gelatin 20°, 48 hours	B. Coli Type (+ = present, — = absent): 10 c.c.	B. Coli Type: 1 c.c.	B. Coli Type: 1-10 c.c.
Saugerties	Ulster	Tap, public supply	10/15/10	2	5	....	....	30	14	16	.002	.026	.001	0.04	1.20	1.50	14.3	13.0	700	—	—	—
Saugerties	Ulster	Tap, public supply	12/21/10	5	Tr.	....	....	23	8	15	.002	.008	.008	0.20	0.50	1.50	15.6	12.0	550	+	+	—
Saugerties	Ulster	Tap, public supply	2/ 8/11	Tr.	5	....	....	29	7	22	.048	.052	.008	0.10	1.60	1.75	12.7	10.0	170	+	—	—
Saugerties	Ulster	Tap, public supply	3/28/11	30	30	....	....	50	26	24	.012	.074	.002	0.10	7.20	2.00	15.6	13.0	1,900	+	+	—
Saugerties	Ulster	Tap, public supply	5/16/11	12	10	....	....	39	15	24	.008	.076	.002	0.10	1.80	1.62	16.9	9.0	3,300	+	—	—
Saugerties	Ulster	Tap, public supply	6/30/11	5	5	....	....	25	9	16	.006	.016	.002	0.10	0.73	1.75	12.7	6.0	200	+	—	—
Saugerties	Ulster	Tap, public supply	9/ 6/11	5	10	....	....	81	17	64	.010	.044	.001	0.04	1.70	1.75	32.5	17.0	6,900	+	+	+
Saugerties	Ulster	Tap, public supply	10/19/11	Tr.	1	....	....	50	18	32	.014	.070	.001	Tr.	0.10	1.62	11.1	9.0	900	+	+	+
Saugerties	Ulster	Tap, public supply	12/ 9/11	5	3	....	....	46	26	20	.006	.026	.002	0.10	1.10	1.50	11.1	2.0	150	—	—	—
Saugerties	Ulster	Tap, public supply	1/23/12	7	Tr.	....	....	42	10	32	.018	.030	.001	0.24	0.90	1.37	12.7	8.0	210	+	—	—
Saugerties	Ulster	Tap, public supply	3/ 1/12	15	Tr.	....	....	41	14	27	.008	.026	.001	0.16	2.50	1.25	11.1	4.0	600	+	+	—
Saugerties	Ulster	Tap, public supply	4/ 5/12	15	5	....	....	34	8	26	.012	.032	Tr.	0.16	1.80	1.00	11.1	5.0	100	+	—	—
Saugerties	Ulster	Tap, public supply	7/31/12	7	2	....	....	40	11	29	.004	.020	Tr.	0.10	0.90	1.50	14.3	13.0	80	+	—	—
Saugerties	Ulster	Tap, public supply	10/ 4/13	5	Cl.	....	....	31	8	23	.004	.030	.001	0.16	1.20	2.50	18.7	10.0	30	—	—	—
Saugerties	Ulster	Tap, public supply	11/ 9/12	30	5	....	....	35	10	25	.014	.050	.001	0.10	4.20	1.37	14.3	14.0	1,000	+	+	—
Saugerties	Ulster	Tap, public supply	1/16/13	5	Cl.	1a.	1a.	31	....	....	.014	.030	Tr.	0.24	0.70	1.50	11.1	5.0	80	0+3—	0+3—	0+3—
Saugerties	Ulster	Tap, public supply	3/14/13	5	40	1v.	1v.	85	....	....	.026	.088	Tr.	0.22	2.90	1.75	16.9	10.0	3,800	3+0—	3+0—	0+3—
Saugerties	Ulster	Tap, public supply	4/25/13	10	2	1v.	1v.	34	....	....	.002	.020	.001	0.12	1.00	1.00	19.5	6.0	120	0+3—	0+3—	0+3—
Saugerties	Ulster	Tap, public supply	6/ 6/13	10	2	1v.	1v.	32	....	....	.004	.024	Tr.	0.06	1.20	1.00	12.7	9.0	40	1+2—	0+3—	0+3—
Saugerties	Ulster	Tap, public supply	7/ 2/13	15	5	2a.	2a.	44	....	....	.008	.070	.003	0.10	1.20	1.50	11.1	10.0	100	3+0—	1+0—	0+3—
Saugerties	Ulster	Tap, public supply	3/26/14	12	5	2v.	2v.	30	10	20	.038	.092	.001	0.14	2.70	1.25	9.5	6.0	1,400	1+2—	0+3—	0+3—
Saugerties	Ulster	Tap, public supply	9/30/14	10	2	2v.	2v.	40	15	25	.006	.048	.001	0.04	1.40	2.13	16.9	11.0	20	0+3—	0+3—	0+3—
Saugerties	Ulster	Tap, public supply	3/17/15	Tr.	Cl.	1v.	1v.	43	4	39	.004	.012	.002	0.16	1.90	9.63	15.6	7.0	50	1+2—	0+3—	0+3—
Saugerties	Ulster	Reservoir at intake	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	100	2+1—	0+3—	0+3—
Saugerties	Ulster	Plattekill creek above West Saugerties	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	30	0+3—	0+3—	0+3—

SCHENEVUS

HERMANN M. BIGGS, M.D., *State Commissioner of Health:*

A reinspection of the public water supply of Schenevus was made on January 8, 1915, by Dr. C. C. Duryee, sanitary supervisor of district "C," and the following facts are based upon the information furnished by him. A full investigation of this supply was made by the engineering division in July, 1908, and the report of this investigation will be found on page 310, volume II of the twenty-ninth annual report of this Department.

There are two separate sources of water supply for this village, the principal one, Sparrowhawk brook and the other from a large spring, which, however, furnishes water to some fifteen houses only. Both supplies are owned and maintained by the Schenevus Village Water Works Company. The present population of Schenevus is about 560 and the daily water consumption is estimated at 40,000 gallons.

Since the previous report a new reservoir has been constructed on the Sparrowhawk brook about two miles above the two reservoirs previously described. This new reservoir, formed by an earthen dam with masonry core wall, has a storage capacity of 10,000,000 gallons. From this reservoir the water flows into the upper one of the old reservoirs thence into a collecting well from which it is carried through two pipes to the third reservoir, whence it is distributed to the village by gravity. At this third reservoir the water passes through a brick and charcoal strainer.

The spring supply has been developed by the construction of a concrete collecting basin around it. This basin is covered by a substantial house and protected from chance visitors. There seems to be little opportunity for contamination of this supply.

The watershed tributary to the brook supply consists of about 1½ square miles of area. This area is a narrow valley with steep side slopes and is practically all cleared land devoted to agriculture. A highway traverses the area parallel to and a short distance from the stream. There are eight occupied houses and one schoolhouse on the watershed and the total resident population is estimated at twenty-four.

The report of the investigation in 1908 listed seven places at which were possible sources of contamination. These sources were privies and manure piles upon the banks of or near the brook or its tributaries. In this early report it was recommended that all sources of pollution be removed and guarded against and that, if necessary, application be made to this Department for the enactment of rules and regulations for the sanitary protection of the water supply.

The recent inspection by Dr. Duryee disclosed the following information regarding the seven sources of pollution noted in the previous report:

1. Hazen farm. This has been purchased by the water company and the privy thereon has been provided with a concrete vault. Four people are now living in this house.
2. Swift farm. There is but one person living on the place at the present time. The privy has been removed about fifty feet and a trench has been dug around the barn in order to prevent drainage from the manure pile reaching the stream.
3. Fink farm. Three people are now living on this farm and the privy has been removed to about 150 feet from the stream and provided with a concrete vault.
4. Unoccupied house. This is still unoccupied and being in a very dilapidated condition will probably never be used again.
5. Jeffrey farm. This place is situated on a small stream that empties into Sparrowhawk brook and is a source of contamination on account of the privy and manure pile. It is the intention, however, of the Water Company to carry the stream past the buildings on this farm through about 500 feet of large tile.

6. Schoolhouse. This has an attendance of 6 or 8 pupils and has two privies, both of which are now provided with concrete vaults.
7. Wilson farm. The privy has been provided with a concrete vault and drainage from the manure pile into the stream prevented.

In addition to the steps noted above the water company has purchased about 400 acres of land upon the watershed and furthermore an employe of the company makes a monthly inspection of the watershed.

It appears then from the data furnished by Dr. Duryee that the water is guarded against and that, if necessary, application be made to this Department in respect to the inspection of the watershed and in their efforts to prevent pollution. No application has been made, however, to this Department for the enactment of rules and regulations.

It is the intention of the water company to take care of the privies located at various farms on the watershed and it is planned to clean out each privy vault once each year and to draw the contents entirely away from the watershed and dispose of them by plowing into the soil at some point off the watershed. It is also the intention of the Water Company to acquire still greater control over the watershed by the purchase of portions of the land from time to time.

At the time of his inspection, Dr. Duryee collected samples of water from the Sparrowhawk brook supply and from the spring and the results of the analyses of these samples together with other analyses made in the past by the Division of Laboratories and Research will be found in the appended table. On the night previous to the collection of the samples by Dr. Duryee there had been a very heavy rainfall and run-off which undoubtedly accounts for the unfavorable results of the analyses of the samples collected by him.

These analyses show a water usually somewhat colored, at times turbid and comparatively soft. The total numbers of bacteria are usually rather high and organisms of the B. coli type occur uniformly in 10 c.c. and frequently in 1 c.c., and occasionally in 1/10 c.c. Such bacterial results indicate that at times there is considerable contamination of animal or human origin. This is probably due to the rapid run-off which washes contaminating material into the stream from the highway, manured fields and possibly from privies.

In view of the above facts the following conclusions may be drawn:

1. That the Water Company has taken commendable steps toward the carrying out of the recommendations of this Department by removing sources of contamination and by maintaining a careful patrol of the watershed.
2. That such measures although supplemented by the purchase of considerable area of the watershed have not sufficed to prevent all contamination of the supply at all times and under all conditions, especially at times of heavy rainfall.

I would therefore recommend that the water company be requested to give their consideration to the installation of some method of water purification for improving the sanitary quality of their water supply. Purification could undoubtedly be depended upon to more adequately safeguard the supply than the most careful sanitary patrol and would probably make unnecessary the expense of additional purchase of land on the watershed.

Respectfully submitted,
THEODORE HORTON,
Chief Engineer

ALBANY, N. Y., *March* 24, 1915

RESULTS OF WATER ANALYSES

Abbreviations used to describe odors of water: 0, none; 1, very faint; 2, faint; 3, distinct; 4, decided; 5, strong; 6, very strong; a aromatic; d, disagreeable; e, earthy; f, fishy; g, grassy; m, musty; v, vegetable

Municipality	County	Source of sample	Date of collection	Physical				Chemical (Parts Per Million)											Bacteriological			
						Odor		Solids			Nitrogen as—						Hardness		Bacteria per c.c.; gelatin 20°, 48 hours	B. Coli Type + = present — = absent		
				Color	Turbidity	Cold	Hot	Total	Loss on ignition	Mineral residue	Free ammonia	Albuminoid ammonia	Nitrites	Nitrates	Oxygen consumed	Chlorine	Total	Alkalinity		10 c.c.	1 c.c.	1-10 c.c.
Schenevus	Otsego	Tap, public supply	5/24/09	1	11	....	....	30	12	18	.030	.184	Tr.	0.10	1.40	0.37	12.7	7.0	250	+	+	—
Schenevus	Otsego	Tap, public supply	7/23/10	5	8	....	....	34	14	20	.016	.050	Tr.	0.08	0.90	0.87	18.2	14.0	1,000	+	—	—
Schenevus	Otsego	Tap, public supply	1/19/11	5	5	....	....	33	11	22	.016	.052	.003	0.50	1.70	1.25	16.9	12.0	450	+	—	—
Schenevus	Otsego	Tap, public supply	4/4/11	10	8	....	....	31	11	20	.026	.100	.001	0.50	1.40	1.25	15.6	11.0	400	+	—	—
Schenevus	Otsego	Tap, public supply	5/4/11	3	1	....	....	29	13	16	.018	.120	.002	0.40	0.30	1.37	15.6	10.0	275	+	+	—
Schenevus	Otsego	Tap, public supply	7/20/11	10	5	....	....	40	15	25	.016	.070	.001	Tr.	1.00	0.75	18.2	12.0	450	+	—	—
Schenevus	Otsego	Tap, public supply	9/6/11	5	Tr.	....	....	48	14	34	.008	.034	Tr.	Tr.	1.20	1.25	22.1	15.0	900	+	+	+
Schenevus	Otsego	Tap, public supply	10/10/11	10	5	....	....	37	11	26	.006	.052	Tr.	0.16	1.20	0.62	19.5	14.0	210	+	+	—
Schenevus	Otsego	Tap, public supply	11/21/11	8	Cl.	....	....	33	11	22	.014	.080	.001	0.30	1.20	1.00	18.2	8.0				
Schenevus	Otsego	Tap, public supply	12/19/11	10	Cl.	....	....	44	18	26	.006	.042	.004	0.06	1.80	1.00	14.3	8.0	40	+	+	—
Schenevus	Otsego	Tap, public supply	2/2/12	5	10	....	....	41	9	32	.012	.050	Tr.	0.40	1.40	1.50	14.3	9.0	80	+	—	—
Schenevus	Otsego	Tap, public supply	4/12/12	10	10	....	....	24	5	19	.036	.074	.001	0.32	1.70	0.50	18.2	4.0	200	—	—	—
Schenevus	Otsego	Tap, public supply	9/10/12	12	4	....	....	67	22	45	.006	.082	Tr.	0.10	2.80	0.50	24.7	21.0	200	+	+	—
Schenevus	Otsego	Tap, public supply	3/3/13	10	8	1 v.	1 v.	41	....	....	.006	.060	Tr.	0.44	1.60	1.00	16.9	9.0	1,800	2+1—	0+3—	0+3—
Schenevus	Otsego	Tap, public supply	4/28/13	Tr.	5	1 v.	1 v.	43	....	....	.002	.050	Tr.	0.16	1.30	0.75	19.5	11.0	1,200	3+0—	0+3—	0+3—
Schenevus	Otsego	Tap, public supply	6/9/13	10	5	1 v.	1 v.	38	....	....	.008	.060	Tr.	0.08	1.00	0.50	15.6	9.0	425	3+0—	2+1—	0+3—
Schenevus	Otsego	Tap, public supply	11/24/13	10	2	1 a.	1 a.	50	20	30	.010	.050	.001	0.40	2.80	1.13	19.5	11.0	100	3+0—	1+2—	0+3—
Schenevus	Otsego	Tap, Sparrowhawk bk. supply	1/8/15	10	20	1 v.	1 v.	64	15	49	.008	.040	.002	3.00	3.10	1.25	20.8	9.0	2,900	3+0	3+0—	1+2—
Schenevus	Otsego	Tap, spring supply	1/8/15	Tr.	Tr.	1 v.	1 v.	51	10	41	.008	.020	.003	1.20	0.50	3.88	29.9	16.0	1,700	3+0—	3+0—	0+3—
Schenevus	Otsego	Tap, Sparrowhawk bk. supply	1/8/15	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	2,600	3+0—	3+0—	1+2—

SCHOHARIE

HERMANN M. BIGGS, M.D., *State Commissioner of Health:*

An investigation of the public water supply of Schoharie was made on July 15, 1915, by Mr. C. M. Baker, assistant engineer assisted by Dr. C. C. Duryee, sanitary supervisor, and Dr. H. F. Kingsley, health officer.

The village of Schoharie is located in the county of Schoharie on Schoharie creek, about 35 miles west of the city of Albany. It is reached over the D. & H. R. R. to Schoharie Junction thence by the Schoharie Valley R. R. to Schoharie. The present population of the village is about 1,000. The village has no public sewer system and sewage is disposed of by cesspools.

The water supply is owned by the village and is derived from a spring on the side of a mountain, about 1½ miles northeast of the village. From this spring the water flows through a 4-inch pipe across Fox creek to a reservoir on the mountain opposite the spring about one mile south of the spring and a mile east of the village. From the reservoir the water is distributed by gravity to the village. The supply is at times augmented by pumping from Fox creek at the point where the main from the spring to the reservoir crosses the creek. About 750 or 75 per cent. of the population are served by the public water supply system, there being a total of 180 service taps of which none are metered. There are no definite data regarding the amount of water consumed. It is claimed that considerable water is wasted, and it is therefore probable that the consumption is rather high. The pressure in the village is about 90 pounds per square inch.

The reservoir to which the supply is conveyed from the spring, and from the creek when water is being pumped from that source, is constructed of concrete and has a capacity of 350,000 gallons. It is not covered but is protected by a fence, the bottom part of which is constructed of ¼-inch mesh screen. The nearest house is below the reservoir and about 500 feet distant. There is a total of about six miles of water mains ranging in size from 4 to 10 inches in diameter. The pump, by means of which the water is pumped from the creek, consists of a 5½ horsepower gasoline engine and a Fairbanks, Morris & Company pump with a capactiy of about 3,000 gallons per hour. During last year, the summer of 1914, the pump was operated 10 hours per day for about eighty days and during this time about 30,000 gallons of water daily was supplied from Fox creek. During the preceding summer it was necessary to pump water from the creek only about one month during the summer.

The spring is located in a small ravine in the side of the mountain and is walled up with stone and covered with a flagstone. The water flows from the spring to a small reservoir about 50 feet below the spring formed by a dam across the ravine. From this basin the water is conveyed across the valley to the reservoir on the opposite hill. The immediate vicinity of the spring is owned by the village and enclosed by a fence, but it is possible for surface wash from the pasture land above to find its way into the supply at times of rainfall. The nearest houses above the spring are about 1½ miles distant and so located that the surface drainage cannot find its way from them to the spring. It is thus apparent that the only sources of contamination are from surface wash and possibly from trespassers in the vicinity of the spring.

During the last few summers, as stated above, it has been necessary to pump at times from Fox creek. Fox creek is the outlet of Warner's lake which is considered locally to be supplied in part by a subterranean passage from Thompsons lake about 3 miles northeast of it. The area of the Fox creek watershed above the intake is about 110 square miles and the total population on it is about 4,350 or 39 per square mile. An inspection of the watershed along Fox creek from the intake to Warner's lake showed that there are about 60 buildings located close to the stream which are sources of serious contamination to this supply. About 40 of these buildings are located close to the stream, so that the pollution and drainage from them finds its way directly into the creek and in several instances excreta from

privies is discharged directly into the stream. At Berne is a stable with a manure bin directly over the stream and there are also four privies located directly over the stream and discharging directly into it. At West Berne and Gallupville, there are a total of about 25 privies of the ordinary type located on the bank of the stream. In fact conditions along this stream are so insanitary that it is hard to conceive how the village has escaped a disastrous epidemic of typhoid fever at such times as this supply has been used.

Samples of water were collected from the spring, from a tap in the village which was being supplied with spring water at the time of the inspection, and also from Fox creek at the intake and sent to the Division of Laboratories and Research for analyses, the results of which are as follows:

REPORT OF WATER ANALYSIS FOR SCHOHARIE

Source		Tap	Tap, spring supply	Spring	Fox creek
Collected on		5/5/11	July 15	July 16	July 16
Color		None	Trace	....	Trace
Turbidity		Clear	3	....	3
Odor, cold		....	2 vegetable	....	2 vegetable
Odor, hot		....	2 vegetable	....	2 vegetable
Solids, total		182	208	....	153
Loss on ignition		12	20	....	30
Mineral residue		170	188	....	123
Ammonia, free		.012	.022	....	.002
Ammonia, albuminoid		.244	.026	....	.054
Nitrites		.003	.001	....	.001
Nitrates		0.24	0.70	....	.020
Oxygen consumed		0.30	1.80	....	4.00
Chlorine		1.35	1.00	....	1.00
Hardness, total		160.0	166.00	....	102.80
Alkalinity		151.0	163.00	....	102.00
Bacteria per c.c		150	40	30	1,500
B. coli type	10 c.c.	....	3+0—	2+1—	3+0—
	1 c.c.	....	0+3—	2+1—	3+0—
	1/10 c.c.	....	0+3—	0+3—	0+3—

The result of these analyses shows a slight turbidity for both the spring and creek waters. The bacterial content of the spring water is comparatively low but the presence of organisms of the B. coli type in three of the 10 c.c. samples collected from the tap and in two of the 10 c.c. and two of the 1 c.c. samples collected from the spring, indicates that contamination from animal sources is finding its way into the spring. This is probably due, however, to surface wash from the pasture land above and could doubtlessly be eliminated by the construction of proper drainage ditches. The bacterial content of the water collected from Fox creek is high and the B. coli type were found present in all of the 10 c. c. and 1 c. c. samples which indicates conclusively the active cotamination of this water.

As a result of this investigation the following conclusions may be drawn:

1. That the spring from which the principal water supply of Schoharie is derived, if properly protected from surface wash, should furnish water satisfactory in quality but not sufficient in quantity at times of drought.
2. That the auxiliary supply derived from Fox creek is very badly contaminated and should in no case be used as a potable supply without purification and then only in case the insanitary conditions along the creek are eliminated.

In view of the above I beg to offer the following recommendations to be acted upon by the village authorities:

1. That adequate protection in the way of drainage ditches be provided to prevent surface wash finding its way into the spring supply.
2. That the emergency use of unpurified Fox creek water be abandoned and a new auxiliary supply be obtained by

(a) The development of properly located wells or springs of unquestioned sanitary quality, or

(b) Providing a modern purification plant for the Fox creek supply. In case the latter method is followed the village should apply to this Department for the enactment of rules and regulatations for the sanitary protection of the supply.

3. That analyses of the public supply be regularly made occasionally during the year to detect any active contamination which may exist in the supply and, should active contamination at any time be found present, steps be immediately taken to determine and eliminate the source of such contamination or to otherwise adequately protect the supply in order that it may at all times be pure and wholesome.

Respectfully submitted,

THEODORE HORTON,
Chief Engineer

ALBANY, N. Y., *September* 15, 1915

SEA CLIFF

HERMANN M. BIGGS, M.D., *State Commissioner of Health*:

An investigation of the public water supply of Sea Cliff was made by Mr. C. M. Baker, assistant engineer, on May 17, 1915.

The incorporated village of Sea Cliff is located in Nassau county on the Oyster Bay division of the Long Island railroad about 29 miles from New York city. It is situated along the east shore of Hempstead harbor. The population of the village during the winter is about 3,000 but it increases in the summer to about 10,000 due to summer residents from the city.

The water supply is owned and operated by the Sea Cliff Water Company, which also furnishes water to Glen Head and Glenwood in the town of Oyster Bay. The plant is located somewhat to the southwest of the village near the harbor. The system consists of driven wells from which the water is pumped into a standpipe whence it is distributed by gravity through the mains to the consumers. It is estimated that about eighty per cent of the winter and 90 per cent. of the summer population receive water from the general supply. There are between seven and eight hundred service taps of which only 40 are metered. It is stated that the daily water consumption during the winter is approximately 300,000 gallons and in the summer months 700,000 gallons. This would correspond to per capita consumption of 125 gallons and 78 gallons per day, respectively. The pressure at the pumping station ranges from 112 to 125 pounds, while in some parts of the village, due to the higher elevation, the pressure is only about 40 pounds.

There are eleven 6-inch wells ranging from 65 to 85 feet in depth and three 10-inch wells about sixty feet in depth. The stratum through which the wells pass is sand. The pumps consist of one Worthington pump with a capacity of 125,000 gallons daily and one Blake pump with a capacity of 800,000 gallons daily. The suction lift on the pumps is about 15 feet. The standpipe which is located about one half mile from the plant, is constructed of steel and has a capacity of 245,000 gallons. The distribution system consists of about 25 miles of pipe ranging from two to eight inches in diameter.

The density of population on the area tributary to the wells within one-quarter of a mile of the plant is about 730 per square mile; within one-half mile, about 1,250 per square mile. Outside of this area and within the limits of the probable area of influence, the population is considerably less, being about 125 per square mile. It was apparent from the inspection that the sewage from the buildings in the vicinity of the plant is discharged directly into the harbor, as is the case with respect to the toilet located at the pumping plant. The nearest buildings are about 250 feet distant from the wells. It would, therefore, appear that there is little opportunity for

direct contamination of the ground water in the immediate vicinity of the wells except possibly from leaky sewers. Throughout the village, the sewage is principally disposed of by cesspools or privies and the ground water thus receives considerable contamination some distance from the wells, but due to this distance and the character of the soil it is possible that the water becomes purified in its passage through the soil.

A sample of water was collected from a tap at the pumping station and sent to the Division of Laboratories and Research for analyses, the results of which, together with those of a previous analysis are recorded below:

REPORT OF WATER ANALYSIS FOR SEA CLIFF

Source		....	Tap at pumping station
Collected on		4/12/15	5/17/15
Color		Trace	Trace
Turbidity		Clear	Clear
Odor, cold		1 vegetable	1 vegetable
Odor, hot		1 vegetable	1 vegetable
Solids, total		56	58
Loss on ignition		15	10
Mineral residue		41	48
Ammonia, free		.006	Trace
Ammonia, albuminoid		Trace	.006
Nitrites		.001	Trace
Nitrates		2.00	2.40
Oxygen consumed		2.00	0.50
Chlorine		5.50	6.75
Hardness, total		27.30	23.40
Alkalinity		12.00	15.00
Iron		....	0.35
Bacteria per c.c.		45	70
B. coli type	10 c.c.	0+3—	1+2—
	1 c.c.	0+3—	0+3—
	1/10 c.c.	0+3—	0+3—

The results of the analyses indicate that the water is satisfactory from a physical standpoint. The nitrogenous matter appearing in the form of free and albuminoid ammonia and nitrites is low, but the figures of 2.00 and 2.40 parts per million for nitrates are rather high. Also the variation in the amount of chlorine from 5.50 to 6.75 parts per million indicates that pollution is at times finding its way into the supply. The results of the first analysis show a low bacterial content with the B. coli type absent, but the results of the analysis of the sample taken at the time of the inspection show a bacterial content of 70 per c. c. with the B. coli type present in one of three 10 c. c. samples. It is thus apparent from the analyses that the supply is subject to pollution which, although generally rendered inactive in its passage through the soil, is at times active and potentially dangerous.

The active contamination indicated by the last analyses is probably due to leaky sewers in the vicinity of the wells, since those from the pumping station pass within 30 or 40 feet of some of the wells. Steps should therefore be taken at once to determine definitely the source of this contamination and to eliminate it. The high nitrates and chlorine are probably partly due to accumulated pollution in the ground water from cesspools and privies of the village although the character of the soil, which is sand and the distance through which the water passes are doubtless such as to render this pollution inactive by the time it reaches the wells it is possible, at certain times when the ground water flow is at a maximum due to seasonal variations or maximum drafts on the wells, this pollution may become active and dangerous. Analyses should, therefore, be occasionally made to determine the existence or absence of active contamination and, should contamination be found to exist at any time after attempts have been made to remove the sources of pollution, steps should be immediately taken either to provide a new supply or to purify the present one. Purification could doubtless be accomplished by sterilizing

the water with liquid chlorine. As a result of this investigation, I would conclude that the public water supply being furnished to the village of Sea Cliff by the Sea Cliff Water Company is subject to indirect contamination due to the accumulation of pollution in the ground water under the village from cesspools and privies and the analyses indicate that active contamination at times occurs which is probably caused by leaks in the sewer from the pumping plant.

I, therefore, beg to submit the following recommendations:

1. That the water company investigate their sewer line from the pumping station to determine whether there are leaks in it which might cause pollution of the ground water and that, to prevent the possibility of such leaks at any time, a cast iron pipe be provided to remove the sewage from the pumping station.

2. That analyses of the water be regularly made occasionally during the year to determine the presence of active contamination which may at any time occur.

3. That, should such active contamination be found present after improvements have been made to eliminate possible sources of pollution, steps be taken immediately

(a) To determine and eliminate the sources of pollution if possible, or if the contamination continues.

(b) Purify or sterilize the supply with liquid chlorine.

(c) Should the above improvements prove ineffective in removing the contamination new wells or other new supply be developed entirely free from any pollution.

Respectfully submitted,

THEODORE HORTON,
Chief Engineer

ALBANY, N. Y., *June* 25, 1915

SENECA FALLS

HERMANN M. BIGGS, M.D., *State Commissioner of Health:*

A reinspection of the public water supply of Seneca Falls was made on August 5, 1915, by Dr. Isaac W. Brewer, sanitary supervisor, of district "Q." A previous investigation of this supply was made in 1910 by the Engineering Division, a full report of which will be found on page 581 of the thirty-first annual report of this Department.

The water supply of Seneca Falls is derived from Cayuga lake at a point near the middle of the northern end of the lake opposite the village of Cayuga. The intake extends about one-half mile into the lake. From this intake the water is pumped through four pressure mechanical filters manufactured by the Roberts Filter Co. of Derby, Pa. The distribution system consists of about 22 miles of cast-iron mains. The pumps are operated against the pressure maintained by a standpipe located in the western portion of the village. This standpipe has a capacity of about 500,000 gallons. The pumps have a capacity of 2,000,000 gallons per day and at the time of the inspection the daily water consumption was about 1,250,000 gallons. The water works are owned and operated by the Seneca Falls Water Co.

The filters are of the ordinary pressure type and consist of horizontal steel cylinders, 8 feet in diameter and 22 feet long. The water enters at the top at one end of the cylinder by a manifold system of pipes and is distributed over the surface of the sand bed forming the filter medium. This sand bed is 30 inches in depth and is Cape May sand. Under the sand is a 12-inch layer of sea shore gravel of perhaps 1 inch in diameter. Under the gravel bed are the collecting nozzles of brass set in another manifold system which conveys the water to the force main. All four of the filters are in continuous service except when one of them is being cleaned. The

filters are washed when the loss of head amounts to five pounds per square inch. These filters were installed in April, 1913.

Alum is used as a coagulant and is added at the rate of about ½ grain per gallon. The superintendent of the plant has recently taken a course in bacteriology and is making regular counts of the water.

Cayuga Lake has a water surface of about 67 square miles and a watershed area of about 800 square miles. There are numerous centers of population on the watershed including the city of Ithaca and the villages of Aurora, Cayuga, Dryden, Freeville, Newfield, Trumansburg and Union Springs. The total population upon the watershed may be estimated at approximately 25,000 people, giving a population of about 30 per square mile. The lake receives sewage from the city of Ithaca at the southern end of the lake and from various villages having sewers and cesspools which discharge more or less directly into the lake.

Along the west shore near the intake there are numerous summer cottages most of which are provided with flush closets which discharge into so called septic tanks, the effluents from which flow or percolate into the lake. The lake in this vicinity is also used to a considerable extent during the summer for bathing purposes.

At the time of the previous inspection it was pointed out that the water supply of Seneca Falls pumped unpurified from Cayuga lake was subject to frequent and dangerous pollution which might become at any time a menace to the health of the citizens. It was, therefore, recommended that the waters be subjected to some approved process of purification, that the sources of contamination of the lake near the vicinity of the intake be abated and that an expert sanitary engineer be employed to investigate and report the means for carrying out these improvements.

From the report of Dr. Brewer it appears that the water company has taken commendable action in installing a filtration plant and in taking precautions to operate it under careful supervision.

At the time of the inspection Dr. Brewer collected samples of water, the results of the analyses of which together with others made in the past by the Division of Laboratories and Research will be found in the appended table.

These analyses show the occasional insanitary condition of the raw water and while the analyses of the filtered water are too few in number to permit the drawing of definite conclusions as to the efficiency of the filtration plant at all times, they do indicate, however, that at the time of the inspection a satisfactory degree of purification was being effected. The filtered water although very hard is free from color and turbidity and is otherwise satisfactory from a physical standpoint. The bacterial counts are low and fecal organisms of the B. coli type absent.

In view of the above facts the following conclusions may be drawn:

1. That the Seneca Falls Water Company has carried out the recommendation of this Department for the installation of a filtration plant for the public water supply of Seneca Falls.
2. That, as far as can be determined at present, this filtration plant is being operated in a satisfactory manner and an efficient degree of purification is being obtained.

In view of the above conclusions it does not seem necessary for me to make further recommendations at this time than that the Water Co., continue its careful oversight of the operations of the filter plant and take every precaution to see that this efficiency is maintained at all times and under all conditions.

Respectfully submitted,

THEODORE HORTON,
Chief Engineer

ALBANY, N. Y., *November* 30, 1915

RESULTS OF WATER ANALYSES

Abbreviations used to describe odors of water: 0, none; 1, very faint; 2, faint; 3, distinct; 4, decided; 5, strong; 6, very strong; a, aromatic; d, disagreeable; e, earthy; f, fishy; g, grassy; m, musty; v, vegetable

Municipality	County	Source of sample	Date of collection	Physical: Color	Physical: Turbidity	Physical: Odor: Cold	Physical: Odor: Hot	Chemical (Parts per Million): Solids: Total	Solids: Loss on ignition	Solids: Mineral residue	Nitrogen as—: Free ammonia	Nitrogen as—: Albuminoid ammonia	Nitrogen as—: Nitrites	Nitrogen as—: Nitrates	Oxygen consumed	Chlorine	Hardness: Total	Hardness: Alkalinity	Bacteriological: Bacteria per c.c.; gelatin 20°, 48 hours	B. Coli Type (+ = present, — = absent): 10 c.c.	B. Coli Type: 1 c.c.	B. Coli Type: 1-10 c.c.
Seneca Falls	Seneca	Tap, public supply	2/12/12	Tr.	Cl.	....	....	306	85	221	.008	.032	Tr.	0.48	0.90	53.00	131.0	123.0	....	....	....	....
Seneca Falls	Seneca	Tap, public supply	3/20/12	5	Cl.	....	....	230	30	200	.020	.058	.005	0.40	0.80	47.00	109.0	106.0	300	—	—	—
Seneca Falls	Seneca	Tap, public supply	10/ 9/12	5	Tr.	....	....	257	90	167	.014	.074	.002	0.18	1.60	48.00	109.0	94.0	800	—	—	—
Seneca Falls	Seneca	Tap, public supply	11/26/13	5	Cl.	....	....	240	29	211	.024	.080	.001	0.34	1.40	51.00	111.0	101.0	100	—	—	—
Seneca Falls	Seneca	Tap, public supply	12/31/12	Tr.	Cl.	....	....	246	27	219	.028	.080	Tr.	0.46	1.20	50.00	111.0	108.0	20	—	—	—
Seneca Falls	Seneca	Tap, public supply	2/ 8/13	10	3	....	....	261	....	+	.012	.068	Tr.	0.50	1.90	50.00	126.0	113.0	300	—	—	—
Seneca Falls	Seneca	Tap, public supply	3/21/13	5	Tr.	....	....	246	....	....	.016	.054	.001	0.34	1.70	49.00	109.0	100.0	20	—	—	—
Filter installed April, 1913.																						
Seneca Falls	Seneca	Tap, public supply	5/16/13	Tr.	Cl.	....	....	253	....	....	.004	.048	.001	0.34	1.20	49.00	114.0	98.0	800	—	—	—
Seneca Falls	Seneca	Tap, public supply	6/20/13	Tr.	1	....	....	224	....	....	.004	.060	.001	0.24	1.10	50.00	114.0	85.0	20	—	—	—
Seneca Falls	Seneca	Tap, public supply	7/25/13	Tr.	Cl.	....	....	222	....	....	.010	.078	Tr.	0.06	1.00	51.00	87.0	56.0	40	—	—	—
Seneca Falls	Seneca	Tap, public supply	1/14/14	Tr.	40	2 a.	2 a.	342	38	304	.034	.082	.004	0.46	2.90	62.00	131.0	103.0	2,500	+	+	—
Seneca Falls	Seneca	Tap, public supply	2/ 3/14	Tr.	Cl.	1 v.	2 v.	277	41	236	.028	.032	.002	0.60	1.80	53.00	143.0	105.0	160	—	—	—
Seneca Falls	Seneca	Tap, public supply	5/ 1/14	Tr.	2	1 v.	1 v.	261	41	230	.012	.072	Tr.	0.46	1.50	49.00	109.0	100.0	140	—	—	—
Seneca Falls	Seneca	Raw water	8/ 5/15	....	....	....	....	....	....	....	....	....	....	....	....	53.00	....	....	60	1+2—	1+2—	0+3—
Seneca Falls	Seneca	Filtered water	8/ 5/15	Tr.	Tr.	2 v.	2 v.	229	23	206	.008	.072	.002	0.30	1.70	52.00	95.7	91.0	20	0+3—	0+3—	0+3—
Seneca Falls	Seneca	Filtered water	8/ 5/15	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	15	0+3—	0+3—	0+3—

SHARON SPRINGS

HERMANN M. BIGGS, M.D., *State Commissioner of Health:*

An investigation of the public water supply of Sharon Springs was made by Mr. C. M. Baker, assistant engineer, on July 15, 1915. Mr. Baker was accompanied on the inspection by Dr. C. C. Duryee, sanitary supervisor of district "C."

Sharon Springs is an incorporated village located in the northwest corner of Schoharie county on the Cherry Valley branch of the D. & H. R. R. It is principally a summer resort and the population therefore is variable, being about 500 in the winter and 2,500 to 3,000 during the summer months.

The water supply is owned by the municipality and is derived from a small lake located about four miles southwest of the village. An intake pipe extends about 300 feet into the lake through which the water flows by gravity to a reservoir located about ¼ mile below the lake. This reservoir is formed by earthen embankments and has a capacity of 3,000,000 gallons. From this reservoir the water flows through pressure mechanical filters located near the village and thence to the village. As there are no meters nor other method of measuring the water consumed, no definite information could be obtained regarding the consumption. There are a total of 162 service taps, none of which are metered. The pressure at the filters is about 30 pounds per square inch and in the village about 100 pounds. A pressure-reducing valve is located in the main leading from the filter plant to the village to prevent excessive pressure at the village. There are between six and seven miles of water mains ranging in size from 4 to 8 inches in diameter.

The purification plant consists of three pressure filters constructed by the International Filter Company of Chicago. The filters are 8 feet in diameter by 5 feet high and are filled to a depth of about 2¾ feet with sand, the effective size of which is 0.64 mm. and the uniformity coefficient 1.25. Assuming a water consumption of 100 gallons per capita per day, the rate of filtration with all the filters in operation would be approximately 86,500,000 gallons per acre per day when the population equals 3,000, the maximum during the summer. Alum is applied to the raw water by means of the shunt system, and the engineer was informed that 30 to 50 pounds per day would be used during the summer season. The filters are washed daily, the system of washing being to wash one filter with the filtered water from the other two. A glass is provided in the waste water line, by means of which the wash water can be observed to determine when the filters are clean. No provision is made for a rewash or filtering to waste after washing the filters. The pressure on the raw water line at the filters at the time of the inspection was 34 pounds per square inch and on the filtered water line 30 pounds, thus showing a loss of head of 4 pounds in passing through the filter. The loss of head at the time of washing, so the assistant engineer was informed, is usually about 5 pounds.

The plant has been recently constructed and had only been in operation about one month prior to the time of the inspection. The assistant engineer was informed that the filters will not be operated during the winter because of the possibility of water freezing in them, due to the fact that no method has been provided for heating the filter house.

The lake from which the supply is derived is about 25 acres in area and has an estimated capacity of approximately 30,000,000 gallons. It is fed by a small stream which enters it from the northwest. The total area of the watershed tributary to the lake is slightly over 1 square mile, the slopes are steep and the majority of the area is used for grazing and agricultural purposes. An inspection of the watershed showed that there are 7 farms on it and a population of about 35 people. One farm located on the stream near the point of discharge into the lake has a barnyard which extends to the stream. At Brookside farm, located about 1 mile from the lake, a privy, provided with a loose plank vault only, is located on the bank of the stream about 4 feet from the water's edge. Another farm, located above this one, is

about 150 or 200 feet distant from the stream. It is thus evident that there are a number of sources of contamination of the supply, although it is possible that the effect of sedimentation in the lake eliminates to some extent the danger from these sources.

The supply is also partly derived from two springs located on the watershed, one of which is satisfactorily located and not directly subject to pollution. The other, however, is located just below a farmhouse and probably receives the drainage to a great extent from the farm, as the rock formation at this place is limestone, which always contains crevices and channels whereby direct surface contamination may reach the ground water. There is a sink hole near the farm which receives the drainage from the vicinity, and the water from this doubtless finds its way quite directly into the spring. In fact, it was stated that some 8 or 10 years ago several cases of typhoid developed among the people using the water from this spring at a time when a case of typhoid was known to have existed at the farmhouse above the spring.

At the time of the inspection and subsequently various samples of water were collected and sent to the Division of Laboratories and Research for analyses, the results of which are as follows:

Source	Raw Water			Filtered Water			Spring Water
		9-1-15			9-1-15		
Time of collection	7-15-15	7:10 A. M.	4 P. M.	7-15-15	7:10 A. M.	4 P. M.	7-15-15
Color	......	......	......	tr.	......	......	tr.
Odor, hot	......	......	......	1 v.	......	......	2 a.
Odor, cold	......	......	......	1 v.	......	......	2 a.
Turbidity	......	......	......	2	......	......	5
Solids, total	......	......	......	145	......	......	144
Loss on ignition	......	......	......	23	......	......	50
Mineral residue	......	......	......	122	......	......	94
Free ammonia	......	......	......	.242	......	......	.004
Albuminoid ammonia	......	......	......	.012	......	......	.060
Nitrites	......	......	......	.006	......	......	.001
Nitrates	......	......	......	.040	......	......	.040
Oxygen consumed	......	......	......	4.30	......	......	3.80
Chlorine	......	2.00	2.00	1.50	2.00	2.00	2.50
Total hardness	......	......	......	82.90	......	......	29.90
Alkalinity	88.00	......	......	78.00	......	......	27.00
Bacteria	70	250	150	9,600	35	35	2,200
B. coli 10 c. c.	2+1—	1+2—	1+2—	3+0—	1+2—	1+2—	3+0—
B. coli 1 c. c.	1+2—	0+3—	0+3—	1+2—	0+3—	0+3—	3+0—
B. coli 1/10 c. c.	0+3—	0+3—	0+3—	0+3—	0+3—	0+3—	1+2—

The results of the analyses indicate that the raw water is somewhat actively contaminated, as shown by the presence of organisms of the B. coli type, although the total numbers of bacteria are moderate. The results of the analyses of the filtered water are variable, the total counts being high and B. coli present in the first sample, while the counts are low in the second and third samples and B. coli only moderately prevalent. The later analyses show a bacteria efficiency for the filter of about 80 per cent. From these analyses it is apparent that the filters as operated were not securing an entirely satisfactory removal of the contamination present in the raw water.

The results of the analyses of the water collected from the spring located just below farmhouse and previously described show a very high bacterial count with the B. coli type present in all of the 10 c. c. and 1 c. c. inoculations and also in one of the 1/10 c. c. inoculations. These results, taken in conjunction with the insanitary conditions in the vicinity of this spring, show clearly that the water is badly contaminated and unsafe for domestic use.

As a result of this investigation, I would conclude:

1. That the water supply of Sharon Springs is derived from a source subject to contamination from surface wash from the vicinity of farmhouses, barnyards, cultivated land and privies.

2. That the comparatively large storage available in the small lake affords a certain amount of protection to the supply through the beneficial effects of sedimentation.

3. That the filter plant as operated cannot be depended upon to remove the contamination and render the water satisfactory for potable purposes at all times and under all conditions unless more constant and competent supervision is provided.

4. That the present method of not allowing the first filtrate after filter washing to be wasted is not in accordance with the best practice.

5. That, in view of the unsatisfactory condition of the raw water, the plan of not operating the filters during the winter because of the necessity of heating the plant is dangerous. This will be especially true during the winter months, since during this season pollution is carried more directly into the source of the supply by rains and melting snows.

6. That the spring located just below a farmhouse is subject to such serious contamination as to render it unsafe as a source of supply.

In view of the above, I beg to offer the following recommendations, to be acted upon by the village authorities:

1. That the quality of the raw water be improved by removing all sources of pollution on the watershed, and that if any difficulty be encountered in bringing this about, application be made to this Department for the enactment of rules and regulations protecting the water supply from contamination.

2. That great care be exercised at all times in the operation of the filtration plant and that after washing the filters water be allowed to waste for a sufficient time to assure effective filtration before the water is turned into the mains.

3. That the filters be operated at all times during the year and that the necessary heat in this filter house be provided during the winter.

4. That the spring supply described above as being unsatisfactory be abandoned and disconnected from the main supply.

In view of the apparent lack of efficient operation of the filtration plant, as above pointed out, and to the prime importance of this feature as affecting the safety of the water supply, it is suggested that the village follow out the plan which is now being quite generally adopted by the more progressive water works managements in this State, of engaging the services of a competent consulting expert to make occasional visits to the plant during the year, to study the local conditions and operation of the filters and give detailed advice as to the best methods to employ to improve the operation of the plant and maintain it at its highest possible efficiency.

Respectfully submitted,

THEODORE HORTON,
Chief Engineer

ALBANY, N. Y., *October 8, 1915*

SHORTSVILLE

HERMANN M. BIGGS, M.D., *State Commissioner of Health:*

An investigation of the public water supply of the village of Shortsville, Ontario county, was made on October 4, 1915, by Mr. M. F. Sanborn, assistant engineer, who was assisted at the time of the inspection by Mr. F. J. Bullock, president of the water board, Mr. Charles Davidson, superintendent of the water works, and Dr. Isaac W. Brewer, sanitary supervisor.

Shortsville is an incorporated village in the town of Manchester, situated in the northerly portion of Ontario county. It is on the Canandaigua outlet

and on the Auburn division of the N. Y. C. & H. R. R. The population at the time of the inspection was estimated at 1,228.

The public water supply is owned and operated by the village and is under the control of the board of water commissioners. The works were designed by Mr. N. A. Brown, civil engineer, of Rochester, and constructed by Dennison & Co. of Rochester in 1909 under the supervision of Mr. Brown. At the time of the inspection a new standpipe was being constructed on a hill a short distance west of the pumping station.

The water is obtained from a driven well, which constitutes the chief source of supply, and from a dug well, both of which wells are located about one mile south of the village. The water is pumped from these wells to the distributing system and storage tank. Fire protection is provided by hydrants, which are placed in various parts of the village.

About 765 persons, or 63 per cent. of the total population, are served by this water supply. There are about 400 houses in the village, of which 243 are served by the system, and all of these sources are metered. The average pressure in the village is about 65 pounds per square inch. The daily consumption as estimated from the pump records is about 25,000 gallons per day, which corresponds to about 33 gallons per capita served. Many of the houses use rain water, collected in cisterns, for washing purposes, and this undoubtedly accounts for the very low consumption per capita of the municipal supply.

There are no sewers in the village, cesspools, septic tanks and privies being in common use.

The supply was originally obtained from the dug well, 17 feet deep, 14 feet square at the bottom and 16 feet square at the surface. Seven 4-inch pipes extend through the lower parts of the side walls. These pipes are aoout 4 feet long and the outer ends are surrounded with gravel. Due to the fineness of the sand forming the soil in the vicinity, this supply has not proved adequate, since the sand readily clogged up the gravel and prevented rapid infiltration of the ground water.

Later two driven wells 6 inches in diameter were sunk. The first one is about 125 feet south of the dug well and was sunk through 5 feet of sand and gravel, 13 feet of quicksand with some boulders and 105 feet of limestone. This well has not as yet been used. The other well is about 250 feet south of the dug well and was sunk through 24 feet of fine sand with some boulders and 64 feet of limestone. This well forms the principal source of water supply for the village, and the water is siphoned over to the dug well, which serves also as a pump well.

Neither of the driven wells have been sealed at the surface of the rock or at the surface of the ground. Around the well which is now in use a concrete chamber 6 feet square and 6 feet deep has been constructed with the tops of the side walls about 6 inches above the ground. The 6-inch casing of the well projects about 6 inches above the concrete bottom of the chamber and a smaller pipe, extending from within the casing, serves as a siphon for conveying the water to the pump well. This smaller pipe passes through an opening in the lower side wall of the concrete chamber. This opening, being somewhat larger than the pipe, has admitted surface water into the chamber on one or more occasions, and this surface water flowing down between the siphon pipe and the casing has mixed with the well water. When this has occurred the supply has been noticeably turbid.

The pumping station, which is located adjacent to the dug well, is 20 feet by 30 feet in plan. The floor and the sides for about 5 feet are of concrete while above this the sides and roof are constructed of wood. The pumping equipment consists of one Gould triplex plunger pump 7¼ inches in diameter and 10-inch stroke. This pump is operated by a 30 horsepower Westinghouse electric motor. The plant is rated at about 250 gallons per minute. The suction lift varies from 8 to 13 feet, depending upon the height of water in the well. The static pressure when the tank is full is about 55 pounds per square inch, while the dynamic pressure with the pumps in operation is about 64 pounds. This shows a loss due to friction of about 9 pounds.

A large elevated steel tank, about 20 feet in diameter and 25 feet high, has been used for the storage of the water supply up to the present time. This tank is located on a small hill in the western part of the village and the bottom of the tank is about 120 feet above the ground. The capacity of the tank is 75,000 gallons, which is equal to about 3 days' consumption at

the present time. The tank is cleaned and painted about every three years and the water mains are flushed out about twice a year.

A standpipe, 20 feet in diameter and 97 feet high, was being constructed at the time of the inspection. This standpipe is located on a hill adjacent to the pumping station, and the elevation of the water in the standpipe will be the same as that now maintained in the tank which is in use at present.

The area of the surface watershed tributary to the wells is about two acres, although the underground area from which the driven wells may draw water is probably several square miles.

The property of the village, which includes about 3¼ acres, is fenced and ordinarily no pollution would reach the wells. There are no houses on the surface watershed. The land directly south of the village property and about 150 feet from the driven well is used for pasture. The surface drainage from this pasture does not, however, flow in the immediate vicinity of the well, and any pollution would have to pass through the soil before reaching the well.

No sanitary conveniences are provided for the men at the pumping station and at the time of the inspection several piles of human excreta were noticed about 25 feet from and 8 feet below the dug well in a depression between the well and the nearby railroad tracks. This excreta had been deposited by the men working upon the new standpipe. While it is possible that pollution from this source would become well purified by passing through the soil before reaching the ground water tributary to the well, such purification cannot be assured, and this insanitary condition should never have been allowed to arise.

At the time of the inspection a sample of water was obtained from a tap in the village, the analysis of which will be found in the appended table.

From the results of this analysis it will be seen that the water is clear, practically odorless and very hard. The figures for the various forms of nitrogen are very low with the exception of that for nitrates, which is very high. The high nitrates, together with the high chlorine, indicate the presence of organic matter of either animal or vegetable origin, which, however, has become well oxidized by passage through the soil; the number of bacteria is moderate, and the absence of B. coli shows that at the time of the collection of the sample the water was apparently free from active or recent pollution.

As a result of this investigation and the analyses, the following conclusions may be drawn:

1. That, although the analyses of samples of the Shortsville water supply collected at the time of the inspection showed a water of a reasonable sanitary quality, there are, however, certain insanitary conditions in the vicinity of the wells which render possible the contamination of the water supply.
2. That the absence of proper sealing of the casing at the wells permits any surface water collecting in the well chamber to mix with the supply.
3. That the deposit of human excreta upon the land between the pump well and the railroad tracks produced a decidedly insanitary condition.

In view of the above conclusions, I would make the following recommendations:

1. That the space between the suction pipes and the casings of both driven wells be sealed in order that any surface water collecting in the chambers may not pass into the system.
2. That suitable sanitary conveniences be provided with removable tight containers for the use of men working at the pumping station.
3. That occasional analyses be made of the water in order to secure evidence as to its sanitary quality at different times of year and under varying hydraulic conditions of the ground water in order that the village authorities may be in a position to ascertain at frequent intervals the existence of any contamination of the water and to take such precautionary and protective measures as may be necessary.

Respectfully submitted,

THEODORE HORTON,

ALBANY, N. Y., *December* 21, 1915 *Chief Engineer*

REPORT OF WATER ANALYSIS FOR SHORTSVILLE

Source		Tap, public supply
Collected on		10/4/15
Color		Trace
Odor, hot		1 v.
Odor, cold		1 v.
Turbidity		Clear
Solids, total		285
Loss on ignition		42
Mineral residue		243
Ammonia, free		.006
Ammonia, albuminoid		.002
Nitrites		.001
Nitrates		4.00
Oxygen consumed		1.00
Chlorine		5.00
Hardness, total		228.5
Alkalinity		223.0
Bacteria per c. c.		60
B. coli type	10 c. c.	0+3—
	1 c. c.	0+3—
	1/10 c. c.	0+3—

Results are expressed in parts per million. + Present. — Absent.
Abbreviations used to describe odors of water: 0, none; 1, very faint; 2, faint; 3, distinct; 4, decided; 5, strong; 6, very strong; a, aromatic; d, disagreeable; e, earthy; f, fishy; g, grassy; m, musty; v. vegetable.

SIDNEY CENTER

HERMANN M. BIGGS, M.D., *State Commissioner of Health:*

A reinspection of the public water supply of Sidney Center was made on August 27, 1915, by Dr. C. C. Duryee, sanitary supervisor of District "C." A previous investigation of this supply was made by the Engineering Division in 1909, the report of which will be found on page 335 volume II of the thirtieth annual report of this Department.

The water supply of Sidney Center is obtained from Herrick Hollow creek at a point about 1½ miles south of the village. At this point a small reservoir has been constructed from which the water is distributed by gravity to the village. The water works system in general remains practically the same as described in the earlier report. Improvements have been made, however, in the intake and the sides and bottom of the reservoir have been cleaned and lined with masonry. In addition to the water derived from the creek a small amount is obtained from three springs located near the reservoir. The water works are owned and operated by the Sidney Center Water Works Company.

The watershed of Herrick Hollow creek above the reservoir is about ½ square mile. About one-half of the area is wooded and the other half is used in part for agricultural purposes. There are 5 houses upon this watershed and the total population may be estimated at about 25. At the time of the earlier report the possibility of contamination at three different farms was pointed out and according to the report of Dr. Duryee, the conditions at these farms remain practically the same as described in the previous report. At the Perkins place there is contamination of the stream by drainage from barnyard, stable and manure pile. The privy is now located about 150 feet from the stream on a springy ground. At the Dougherty place drainage from the barnyard and manure pile reaches the stream. There is also the possibility of contamination from the privy at this farm. At the Dumond place the privy is located on springy ground about 40 feet from the stream.

The previous report recommended that all sources of contamination be removed, that, if necessary, application be made to this Department for enactment of rules and regulations for the protection of the water supply, that the reservoir be thoroughly cleaned, that steps be taken to provide better circulation of the water in the reservoir, a new intake pipe be provided, the reservoir be covered and the algae growth be kept under control by application of copper sulphate. It was also recommended that an engineer be

employed to advise the company as to the best means of carrying out the recommendations.

From the report of Dr. Duryee, it appears that the water company has carried out the principal recommendations relative to improvements in the reservoir and in the arrangement of the intake and spillway. The company however, has made few improvements in the sanitary conditions upon the watershed.

At the time of his inspection Dr. Duryee collected samples of water and the results of the analyses of these samples will be found in the appended table. These analyses are too few in number to permit the drawing of any definite conclusions as to the quality of the water at all times and under all conditions. They do, however, show that at the time of the inspection the water was somewhat colored and turbid and moderately soft. The figures for nitrogen in its various forms are somewhat high indicating moderate amounts of decomposable and decomposing organic matter. The chlorine content is also above the normal found in uncontaminated surface waters in this vicinity. Bacterial counts are high and the occurrence of fecal organisms of the B. coli type indicate a certain amount of active contamination of human or animal origin.

In view of the above facts the following conclusions may be drawn:

1. That the Sidney Center Water Works Company has carried out several of the recommendations of this Department although there still remain certain improvements to be made in connection with the sanitary conditions upon the watershed.
2. That the water supply is now subject to active contamination by surface wash from barnyards, manured fields and in some cases privies.

I would, therefore, recommend:

1. That the Sidney Center Water Works Company take steps to remove and abate all insanitary conditions upon the watershed.
2. That in case any difficulty be experienced in carrying out the preceding recommendation the company apply to this Department for rules and regulations for the sanitary protection of the water supply.
3. That the Water Company consider the desirability of sterilizing the supply with liquid chlorine in order to minimize the danger arising from accidental, incidental or wilful contamination of the supply.

Respectfully submitted,

THEODORE HORTON,
Chief Engineer

ALBANY, N. Y., *December 7, 1915*

REPORT OF WATER ANALYSIS FOR SIDNEY CENTER

Source		Tap, public supply	Reservoir
Collected on		8/27/15	8/27/15
Color		10	....
Odor, hot		1 v.	....
Odor, cold		1 v.	....
Turbidity		1	....
Solids, total		92	....
Loss on ignition		30	....
Mineral residue		62	....
Ammonia, free		.004	....
Ammonia, albuminoid		.102	....
Nitrites		.002	....
Nitrates		.060	....
Oxygen consumed		3.90	....
Chlorine		1.75	....
Hardness, total		28.6	....
Alkalinity		27.0	....
Bacteria per c. c.		700	220
B. coli type	10 c. c.	3+0—	3+0—
	1 c. c.	0+3—	1+2—
	1/10 c. c.	0+3—	0+3—

Results are expressed in parts per million. + Present. — Absent.

Abbreviations used to describe odors of water: 0, none; 1, very faint; 2, faint; 3, distinct; 4, decided; 5, strong; 6, very strong; a, aromatic; d, disagreeable; e, earthy; f, fishy; g, grassy; m, musty; v, vegetable.

SILVER CREEK

HERMANN M. BIGGS, M.D., *State Commissioner of Health:*

A reinspection of the public water supply of Silver Creek was made on January 20, 1915, by Dr. J. J. Mahoney, sanitary supervisor of district "M" and the following information regarding the present condition of the supply is based upon data furnished by him. A full investigation of this water supply was made by the Engineering Division in 1912 and the report of this investigation will be found on page 749 of the thirty-third annual report of this Department.

Silver Creek is a village of about 2,500 inhabitants. The public water supply is obtained by gravity from Silver creek at a point about 4½ miles south of the village where the water is impounded in a reservoir located just above the hamlet of Smith's Mills. The water works are owned and operated by the municipality, and the reservoir, distribution system and water works in general remain practically the same as at the time of the previous inspection.

The watershed tributary to this supply is approximately 15 square miles in area. This area is crossed by numerous highways and by a branch of the Erie R. R. According to the U. S. Geological Survey map there are in the neighborhood of 135 dwellings upon the watershed and, therefore, the resident population may be estimated at 675 or about 45 per square mile. The area is largely devoted to agriculture and there is considerable opportunity for pollution from manured fields, highway wash, barnyards, etc. The railroad crosses the stream or its tributaries five times thereby affording opportunity for contamination from the toilets of the passenger coaches. The area is hilly and the runoff rapid and although the majority of the houses are well distant from the stream, filth may be quickly washed into the stream and thence carried in a comparatively short time to the water works reservoir.

At the time of the previous investigation, insanitary conditions were noted at a few farm houses above the intake, in respect to the location of manure piles, privies and other sources of contamination near the stream or its tributaries. The recent inspection disclosed the fact that some improvements have been made in remedying such conditions. At one point about 2¼ miles above the reservoir one privy has been moved a distance of 125 feet from the bank of the brook upon which it was formerly located and a house drain which formerly discharged directly into the stream has been changed so as to discharge elsewhere. Otherwise, conditions on the watershed remain unchanged.

The previous report pointed out that this water supply was subject to considerable direct contamination from animal organic matters having their source in barnyards, manure piles, pasture lands, manured fields, and to some extent from privy vaults and waste water from dwellings and that such conditions were a serious menace to the public health in the event of the occurrence of infectious diseases upon the watershed and were at all times a great injury to the esthetic quality of the water. It was, therefore, recommended:

1. That the board of water commissioners proceed at once to have installed a modern plant for the purification of the village water supply. This plant should be installed only after careful study and report by a competent engineer of local conditions and as to the best type, location and capacity of such purification works.
2. That in order to reduce to a minimum the present and future pollution on the watershed and thus relieve the load to be carried by the purification plant, the board of water commissioners apply to this Department for the enactment of rules and regulations for the protection against contamination of the watershed of their supply.
3. That awaiting the carrying out of these protective and corrective measures against existing and future pollution of the water supply and in order to remove at once the serious menace to public health that now

exists from the pollution upon the watershed, the board of water commissioners make at once a thorough inspection of the watershed for the purpose of ascertaining and removing so far as possible all such pollution; and that they maintain a strict sanitary patrol over the watershed to discover any cases and guard against any infection from typhoid fever or other communicable diseases.

4. That if these temporary precautionary measures prove to be inadequate or difficult of attainment, the board of water commissioners consider at once the installation of a temporary chlorinating plant for the sterilization of their supply until the more permanent and efficient purification works are installed.

From the report of Dr. Mahoney, it appears that the only improvements carried out along the lines of these recommendations are those made at the farm 12¼ miles above the reservoir, although an inspection is made by an employee of the water board two or three times a year.

At the time of his inspection Dr. Mahoney collected samples of water from this supply and the results of the analyses of these samples together with others made by the Division of Laboratories and Research since the previous investigation will be found in the appended table.

These analyses show a water somewhat colored, moderately hard and at times very turbid. The total numbers of bacteria are usually excessive and organisms of the B. coli type occur uniformly in 10 c. c., frequently in 1 c. c. and occasionally in 1/10 c. c. Such results indicate active contamination by animal or human excreta at practically all times.

In view of the above facts, the following conclusions may be drawn:

1. That the recommendations of this Department have been carried out to a very limited degree only.

2. That, as previously pointed out the water supply of Silver Creek is of very poor sanitary quality due to contamination by surface wash from an area with a comparatively large resident population.

3. That the supply is further menaced by the opportunities for contamination from the passenger coaches on the railroad at the various points where the tracks cross the stream or its tributaries.

4. That the esthetic quality of this water supply is also unsatisfactory due to the occurrence of turbidity and organic matter washed into the stream from manured fields and pasture lands.

I would, therefore, suggest that the following recommendations be made to the village authorities:

1. That the village authorities consider the advisability of requesting this Department to enact rules and regulations for the sanitary protection of the water supply in order to limit contamination on the watershed as much as possible.

2. That the village take steps at once for the installation of a modern filtration plant.

3. That pending the installation of such plant the village install and operate a plant for the sterilization of the supply with hypochlorite of lime or liquid chlorine.

Respectfully submitted,

THEODORE HORTON,
Chief Engineer

ALBANY, N. Y., *March* 31, 1915

RESULTS OF WATER ANALYSES

Abbreviations used to describe odors of water: 0, none; 1, very faint; 2, faint; 3, distinct; 4, decided; 5, strong; 6, very strong; a, aromatic, d, disagreeable; e, earthy; f, fishy; g, grassy; m, musty; v, vegetable

Municipality	County	Source of sample	Date of collection	Physical				Chemical (Parts per Million)											Bacteriological			
						Odor		Solids			Nitrogen as—						Hardness			B. Coli Type (+ = present, — = absent)		
				Color	Turbidity	Cold	Hot	Total	Loss on ignition	Mineral residue	Free ammonia	Albuminoid ammonia	Nitrites	Nitrates	Oxygen consumed	Chlorine	Total	Alkalinity	Bacteria per c.c.; gelatin 20°, 48 hours	10 c.c.	1 c.c.	1-10 c.c.
Silver Creek...	Chautauqua...	Tap, public supply.........	11/ 8/12	20	20	....	....	119	26	93	.014	.006	.001	0.30	3.30	2.50	71.4	64.0	700	+	—	—
Silver Creek...	Chautauqua...	Tap, public supply.........	12/10/12	20	5	....	....	114	12	102	.018	.086	Tr.	0.31	1.20	2.25	65.7	58.0	190	+	+	—
Silver Creek...	Chautauqua...	Tap, public supply.........	1/20/13	25	10	1 v.	1 v.	77	....	....	.060	.076	Tr.	0.70	2.00	2.00	50.0	40.0	400	3+0—	0+3—	0+3—
Silver Creek...	Chautauqua...	Tap, public supply.........	2/17/13	10	5	1 v.	1 v.	108	....	....	.018	.068	Tr.	0.36	2.30	2.25	62.9	51.0	80	1+2—	0+3—	0+3—
Silver Creek...	Chautauqua...	Tap, public supply.........	3/31/13	20	80	1 v.	1 v.	74	....	....	.030	.088	.001	0.30	2.60	1.37	41.6	33.0	....	3+0—	1+2—	0+3—
Silver Creek...	Chautauqua...	Tap, public supply.........	5/19/13	20	7	2 a.	2, a	149	....	....	.022	.074	Tr.	0.16	2.40	1.75	85.7	81.0	6,300	3+0—	1+2—	0+3—
Silver Creek...	Chautauqua...	Tap, public supply.........	7/ 7/14	10	10	1 v.	1 v.	141	....	....	.014	.118	.002	0.06	3.00	2.00	90.0	78.0	160	3+0—	0+3—	0+3—
Silver Creek...	Chautauqua...	Tap, public supply.........	4/13/14	15	15	1 v.	1 v.	92	14	78	.032	.080	Tr.	0.44	3.00	1.50	47.1	36.0	130	2+1—	1+2—	0+3—
Silver Creek...	Chautauqua...	Tap, public supply.........	1/20/15	20	4	2 v.	2 v.	121	30	91	.114	.082	.003	0.36	3.40	3.00	74.3	62.0	900	2+1—	1+2—	0+3—
Silver Creek...	Chautauqua...	Reservoir..................	1/20/15	15	5	1 v.	1 v.	62	12	50	.026	.074	.002	0.50	3.60	1.50	47.1	27.0	3,300	3+0—	3+0—	3+0—

SINCLAIRVILLE

HERMANN M. BIGGS, M.D., *State Commissioner of Health:*

An investigation of the public water supply of the village of Sinclairville was made on July 9, 1915, by Mr. E. S. Chase, assistant engineer in this Department.

Sinclairville is an incorporated village with a population of about 500, located in the eastern central part of Chautauqua county on the Dunkirk, Allegheny Valley and Pittsburg Railroad about 25 miles south of the city of Dunkirk. The village is the center of a dairying district and, except for a condemned milk factory, there are no industries located in the village.

The public water supply is derived from three groups of springs located in the hills about three miles northeast of the village. The water from these springs is collected in concrete chambers and thence distributed to the village by gravity against a pressure maintained by a storage and equalizing reservoir located on a side hill east of the village. The water works were originally constructed about the year 1896 by the Sinclairville water works company but were later purchased by the village and are now operated by the board of trustees, of which Mr. H. S. Edmonds is president and Mr. M. N. Smith superintendent. Practically the entire population is served by the supply. The distribution system consists of about 5 miles of cast-iron pipe, ranging in size from 2 to 6 inches in diameter. There are 125 service taps, of which none are metered. The daily water consumption is unknown, as is also the average pressure in the village.

The three sets of springs are known as the Johnson, Torrey and Irwin springs respectively. The Johnson springs are located in the valley of a small stream and the water is collected by means of a system of drain tile laid in water-bearing gravel at a depth of about 5 feet below the surface. The water collected by these tile is received in a small concrete basin 3 by 5 feet in plan and 4 feet deep. This basin is provided with a concrete cover, which is kept locked. The inlet from the collecting system has a gate valve by which the amount of water discharged into the basin may be regulated. The outlet pipe leading from the basin is provided with a wire screen of ⅛-inch mesh.

The Torrey springs are located in a gully formed by a small surface stream. These springs are about ⅛ of a mile north of the Johnson springs. They are developed by a somewhat complicated system of collecting tile extending up hill along the bed of the brook. This collecting system extends into a concrete basin similar to that at the Johnson springs.

The Irwin spring is located on a side hill about ½ mile northwest of the other sets of springs. At this spring there is a concrete basin approximately 12 by 24 feet in plan and 5½ feet deep, which collects the water from a spring issuing from underneath a large rock forming part of the northerly wall of the basin. This basin is uncovered save for a roof of wire screen.

The distributing reservoir, located near the village, is 22 by 50 feet in plan, 5 feet deep, and has an estimated capacity of 40,000 gallons. This reservoir is constructed of concrete and is covered with a wooden roof.

The drainage area tributary to the Johnson springs is 1 square mile in area. There are but 2 houses located on this watershed and these are ¾ and 1 mile respectively distant from the stream that flows near the springs. This area is largely cleared land used for grazing purposes. The surface soil is a clayey gravel while the gravel underneath the surface is approximately 15 feet deep overlying rock. There seems to be little if any opportunity for direct contamination of these springs, although there is some possibility of surface drainage from the pasture land reaching the water-bearing gravel without adequate purification.

The Torrey springs watershed is about .2 of a mile in area, upon which there is one house only a few hundred feet from the lines of collecting tile and about 200 feet from the brook. There is some possibilty of surface wash from pasture land and from the barnyard reaching the underground supply

from which this spring is developed. At the time of the inspection some turbidity was noticed in the water collected in the concrete basin. A portion of the collecting tile for this spring is laid in swamp muck and it is evident that water from such source may be very high in organic matter and unsatisfactory from an esthetic standpoint. The supply obtained from these springs has failed to come up to expectations and it would seem that this supply could be shut off from the other springs without affording any marked diminution in the quantity of water obtainable.

The watershed of the Irwin spring is very small, being less than .1 of a square mile in area, and is covered with woods. These woods are adjacent to pasture land, on which many head of cattle are kept, which have access to the immediate vicinity of the spring. At the time of the inspection the walls of the concrete basin were practically flush with the surface of the ground and during heavy rainfall it seems probable that surface wash from the land upon which cattle are pastured reaches this spring.

In addition to the three sets of springs which are already in use, another set, known as the Spier springs, is to be developed in the near future. These springs are located on the side hill in the pasture lot about 1 mile nearer the village than the other springs. The surface watershed of these springs is very small, but it is claimed that an unfailing supply of constant quality may be obtained at all times from these springs. It is planned to develop these springs in a manner similar to the development of the Johnson springs.

At the time of the inspection samples of water were collected for bacterial analyses from each of the three sets of springs now in use and chemical and bacteriological samples were collected from a tap in the village. The results of these analyses, together with the others made in the past by the Division of Laboratories and Research, will be found in the appended table.

These analyses show a hard, clear and practically colorless water. Figures for free and albuminoid ammonia and oxygen consumed indicate a small amount of unoxidized organic matter, probably of vegetable origin. The figures for nitrates, or nitrogen in its oxidized form, are comparatively high, indicating the occurrence of organic contamination in the past, which, however, has become well purified by its passage through the soil. The chlorine content is 10 to 20 times the normal for this region, also indicating the occurrence of contamination in the past. In view of the conditions upon the watershed, it is probable that these results are due to contamination from animal rather than from human sources.

The total numbers of bacteria are as a rule low, although at times somewhat high. In some cases the high counts may have been due to multiplication in transit before the samples reached the laboratory. Organisms of the B. coli type are frequently present in 10 c. c. samples, only occasionally in 1 c. c. and absent in 1/10 c. c.. The presence of these organisms is undoubtedly due to contamination by surface wash from the pastures which surround the springs.

The samples taken at the time of the recent inspection show a rather large amount of active contamination, as indicated by B. coli results. Previous to the collection of these samples a very heavy rainfall had occurred, and it seems probable that surface water in an unpurified condition was reaching these springs. It will be noticed, however, that the lowest count and the fewest organisms of the B. coli type were found in the Johnson spring, while the highest counts were found in the Irwin spring. This is probably due to the fact that the Irwin reservoir was less protected from surface wash than the other springs.

In view of the above facts, the following conclusions may be drawn:

1. That the public water supply of Sinclairville is of a reasonably satisfactory sanitary quality, although there is some opportunity for contamination of animal origin.

2. From a consideration of the topography in the vicinity of the various springs it would appear that it is possible to obtain by proper development a greater quantity of water from the Johnson springs than from any of the other sets of springs.

3. That the Torrey springs are somewhat poorly developed and are more open to organic contamination of animal and human origin than the other supplies.

4. That the Irwin spring as developed at present is open to considerable surface wash from pasture lands.

5. That the Spier springs if properly developed and protected from surface wash would probably afford a supply of satisfactory sanitary quality. The supply obtained from this source would probably be somewhat limited in quantity owing to the restricted watershed tributary to the spring.

I would therefore recommend:

1. That in the case of all the springs the area within 50 feet of the collecting tiles should be fenced off in order to prevent access of cattle to the immediate vicinity.

2. That the Torrey spring either be more adequately developed and protected or else abandoned.

3. That the Irwin spring be protected from surface wash by drainage ditches around the outside walls of the collecting basin.

4. That the Spier spring be developed in such a way that there will be no possibility of its contamination by surface wash from the surrounding pastures.

If the above recommendations are carefully and thoroughly carried out there seems to be no reason why the public supply of Sinclairville should not be of a satisfactory, sanitary and esthetic quality.

Respectfully submitted,

THEODORE HORTON,
Chief Engineer

ALBANY, N. Y., *August* 12, 1915

RESULTS OF WATER ANALYSES

Abbreviations used to describe odors of water: 0, none; 1, very faint; 2, faint; 3, distinct; 4, decided; 5, strong; 6, very strong; a, aromatic, d, disagreeable; e, earthy; f, fishy; g, grassy; m, musty; v, vegetable

Municipality	County	Source of sample	Date of collection	Physical				Chemical (Parts Per Million)											Bacteriological			
						Odor		Solids			Nitrogen as—						Hardness			B. Coli Type + = present — = absent		
				Color	Turbidity	Cold	Hot	Total	Loss on ignition	Mineral residue	Free ammonia	Albuminoid ammonia	Nitrites	Nitrates	Oxygen consumed	Chlorine	Total	Alkalinity	Bacteria per c.c.: gelatin 20°, 48 hours	10 c.c.	1 c.c.	1-10 c.c.
Sinclairville....	Chautauqua...	Tap, public supply..........	3/23/10	Tr.	Cl.	....	....	136	27	109	.076	.072	.002	1.60	1.00	4.00	97.1	85.0	2,200	+	—	—
Sinclairville....	Chautauqua...	Tap, public supply..........	4/18/11	5	Cl.	....	....	109	12	97	.008	.088	.001	0.60	0.20	2.75	95.7	94.0	20	—	—	—
Sinclairville....	Chautauqua...	Tap, public supply..........	11/ 4/11	5	Cl.	....	....	139	26	113	.012	.028	.001	1.20	0.50	3.50	105.8	97.0	60	+	+	—
Sinclairville....	Chautauqua...	Tap, public supply..........	3/ 6/12	5	Cl.	....	....	128	24	104	.018	.014	.001	1.44	0.30	3.00	97.1	88.0	15	—	—	—
Sinclairville....	Chautauqua...	Tap, public supply..........	4/17/12	Tr.	Cl.	....	....	155	18	137	.004	.006	Tr.	1.60	0.40	3.50	115.8	90.0	20	+	—	—
Sinclairville....	Chautauqua...	Tap, public supply..........	12/13/12	5	Cl.	....	....	149	18	131	.006	.024	.001	1.50	0.30	4.25	105.8	99.0	120	—	—	—
Sinclairville....	Chautauqua...	Tap, public supply..........	1/24/13	Tr.	Cl.	....	....	156	....	....	.012	.048	.001	2.00	0.60	5.75	105.8	103.0	10	—	—	—
Sinclairville....	Chautauqua...	Tap, public supply..........	2/21/13	Tr.	Cl.	....	....	118	....	....	.022	.038	Tr.	1.00	1.00	3.37	87.1	83.0	1,800	+	—	—
Sinclairville....	Chautauqua...	Tap, public supply..........	4/ 2/13	Tr.	Cl.	....	....	147	....	....	.018	.022	Tr.	1.40	0.70	4.50	100.0	93.0	50	+	—	—
Sinclairville....	Chautauqua...	Tap, public supply..........	5/22/13	Tr.	Cl.	....	....	121	....	....	.012	.010	.001	1.00	0.30	2.75	85.8	82.0	475	+	—	—
Sinclairville....	Chautauqua...	Tap, public supply..........	7/11/13	Tr.	Cl.	....	....	139	....	....	.004	.004	.001	0.60	0.10	2.75	87.1	86.0	1,600	+	+	—
Sinclairville....	Chautauqua...	Tap, public supply..........	4/14/14	Tr.	Tr.	1 v.	1 v.	107	18	89	.018	.042	.001	0.70	1.50	1.75	68.6	67.0	90	3+0—	0+3—	0+3—
Sinclairville....	Chautauqua...	Tap, public supply..........	7/ 9/15	Tr.	Cl.	1 v.	1 v.	110	10	100	.002	.006	Tr.	0.60	0.90	1.75	74.3	73.0	250	3+0—	2+1—	0+3—
Sinclairville....	Chautauqua...	Johnson spring..............	7/ 9/15	....	....	....	....	....	....	....	....	....	....	....	....	......	......	......	120	3+0—	2+1—	0+3—
Sinclairville....	Chautauqua...	Torrey spring...............	7/ 9/15	....	....	....	....	....	....	....	....	....	....	....	....	......	......	......	350	3+0—	2+1—	0+3—
Sinclairville....	Chautauqua...	Irwin spring................	7/ 9/15	....	....	....	....	....	....	....	....	....	....	....	....	......	......	......	1,100	3+0—	2+1—	1+2—

SLOATSBURG

HERMANN M. BIGGS, M.D., *State Commissioner of Health:*

A reinspection of the public water supply of Sloatsburg was made October 27, 1914, by Dr. W. J. Denno, sanitary supervisor of district "F." An earlier report of a full investigation of this supply by the Engineering Division will be found on page 753 of the thirty-third annual report of this Department.

The public water supply of this village is derived from a watershed lying in the Ramapo mountains southwest of the village upon which there are two relatively large ponds. The lower one of these ponds from which the water supply is taken is an artificial reservoir. This reservoir is known locally as Cranberry pond, and the other adjacent lake as Nigger pond, although on the U. S. government maps they are named Nigger pond and Portage lake respectively and are designated in the previous report according to the government map. The water works are owned and operated by the Pothat water company and the greater amount of water consumption is supplied to the Erie Railroad, while only about 20 houses in the village are supplied from this source.

The water works system and conditions upon the watershed are described by Dr. Denno as remaining practically the same as at the time of the earlier investigation. At the time of his inspection Cranberry pond was almost dry and decomposing organic matter and algae were present in such quantities as to make the water very objectionable from an esthetic viewpoint. While Cranberry pond seems very unsuitable as a source of potable water supply, Nigger pond (Portage lake in the earlier report) is apparently suitable for such purposes, although the use of this lake for water supply is refused by the owner.

The earlier report pointed out certain opportunities for pollution and showed strongly the unsatisfactory esthetic quality of the water, and made the following recommendations for improvements:

1. That, in view of the unsuitableness as a storage for public water supply and the opportunities for animal pollution of its waters, Cranberry pond be abandoned for household water supply.
2. That the intake and works for the supply for household purposes be placed at Nigger pond and that mains of adequate size be laid from the lake to the village to maintain at all times a proper pressure for fire protection.
3. That the mains supplying the village for household purposes be separated from the mains supplying the railroad with water from Cranberry pond and that all water for drinking purposes at the railroad stations or any places supplied by these works be taken from the mains connected with the Nigger Pond supply. That, if necessary, in the future the supply taken from Nigger pond be augmented by the interception of upland water now flowing into Cranberry pond at such elevation that it can be brought into the system by gravity.
4. That the village distribution system be equipped with a proper number of suitable fire hydrants to provide adequate fire protection in the village.
5. That regular and frequent inspections be made of all watersheds and reservoirs from which the public water supply is obtained to prevent any accidental or other dangerous pollution of the supply.
6. That no one be allowed upon the watersheds or reservoirs for the purpose of ice cutting, boating or other purposes which might result in contamination of the water except under strict supervision of the water company.

From the inspection of Dr. Denno it would appear that none of these recommendations have been acted upon. In view of the attitude of the owner of Nigger pond (Portage lake in the former report), it is evident that this source is not available except through condemnation proceedings.

At the time of his inspection samples of water were collected by Dr. Denno, and the results of the analyses of these samples made by the Division of Laboratories and Research will be found in the appended table.

These analyses show a water of the same general chemical and bacteriological characteristics as described in detail in the previous report. The occurrence of high free ammonia and high nitrates indicates considerable decomposition of organic matter and the occurrence of B. coli in small dilutions would indicate more or less contamination of animal or human origin.

In view of the foregoing, the following conclusions may be drawn:

1. That the recommendations of this Department have not been acted upon by the Pothat water company.
2. That the present supply is undoubtedly unsatisfactory from an esthetic viewpoint and somewhat unsatisfactory from a sanitary viewpoint.
3. That the supply is also inadequate for supplying both railroad and village.
4. That in this region a satisfactory supply could undoubtedly be developed adequate in quantity and free from contamination.

I would therefore recommend that

1. The water company carefully consider the recommendations of the previous report as set forth above.
2. That in case it is impracticable to improve the present supply to such a degree as to make it suitable for potable purposes, the water company make a study of the possibility of securing an entirely new and adequate supply from some source free from contamination.

Respectfully submitted,

THEODORE HORTON,
Chief Engineer

ALBANY, N. Y., *March* 13, 1915

REPORT OF WATER ANALYSIS FOR SLOATSBURG

Source		Reservoir Cranberry pond	Outlet Nigger pond	Tap, public supply
Collected on		10/27/14	10/27/14	10/27/14
Color		70	....	....
Turbidity		10	....	....
Odor, cold		1 a.	....	....
Odor, hot		1 a.	....	....
Solids, total		105	....	....
Loss on ignition		49	....	....
Mineral residue		56	....	....
Ammonia, free		.700	....	....
Ammonia, albuminoid		.222	....	....
Nitrites		.020	....	....
Nitrates		0.04	....	....
Oxygen consumed		9.60	....	....
Chlorine		1.25	....	....
Hardness, total		33.8	....	....
Alkalinity		24.0	....	....
Bacteria per c. c.		20,000	100	20,000
B. coli type	10 c. c.	3+0—	1+2—	3+0—
	1 c. c.	3+0—	0+3—	3+0—
	1/10 c. c.	2+1—	0+3—	1+2—

Results are expressed in parts per million. + Present. — Absent.

Abbreviations used to describe odors of water: 0, none; 1, very faint; 2, faint; 3, distinct; 4, decided; 5, strong; 6, very strong; a, aromatic; d, disagreeable; e, earthy; f, fishy; g, grassy; m, musty; v, vegetable.

SMYRNA

HERMANN M. BIGGS, M.D., *State Commissioner of Health:*

A reinspection of the public water supply of Smyrna was made on August 26, 1915, by Dr. Paul B. Brooks, sanitary supervisor of district "D." A previous inspection of this water supply was made in 1910 by the Engineering Division, a full report of which will be found on page 773 of the thirty-second annual report of this Department.

The water supply of this village is derived chiefly from a well located in the lower part of the village near the railroad and in the valley of Pleasant brook. A small amount of water is derived from springs located above and some 900 feet from the reservoir. This reservoir is located on a side hill, northwest of the village. The water works system remains practically the same as described in detail in the early report. The water works are owned and operated by the village.

Conditions in the vicinity of the wells and springs are practically the same as at the time of the previous inspection. Since that time, however, a depression described as a "sink hole" between the railroad station and the pump house in the village, has been largely filled in with cinders so that stagnant water no longer remains there.

The water from the springs above the reservoir is collected in a well approximately 22 feet deep and 3 or 4 feet in diameter, built of stone. From this well the water flows into another shallower well and thence through an iron pipe into the reservoir. These wells are covered with slabs and entirely covered with earth and sod. They are located in a tract of land now used as pasture. During ordinary seasons very little water is derived from this source but during the present summer there has been a constant flow.

At the time of the earlier report it was pointed out that the ground water in the neighborhood of the water supply well was probably being contaminated by sewage from neighboring houses which reached the underground supply through abandoned wells used as cesspools. Three or four weeks previous to the reinspection an incident occurred which suggests the possibility of pollution of the water in the well by surface seepage. Shortly before a very heavy rain, a state road running through the village, upon an elevation some 800 feet northwest of the pumping station, was heavily oiled so that oil ran over the edges of the road generally. The barrels which had contained this oil were piled at a point near the depot, between it and the pumping station. For a day or two following the rain, there was a very general complaint in regard to the taste and odor of the water. Dr. Fairchild, the health officer, passed considerable quantity of the water through filter paper upon which he was able to detect what was evidently road oil. In the course of a few days this taste and odor of road oil disappeared from the water. It would appear then that surface water carrying with it surface impurities must at times reach the ground water supply tributary to the well.

At the time of the earlier report the following recommendations were made:

1. That the discharge of sewage and all household waste into abandoned wells be discontinued.
2. That the depression spoken of and existing near the railroad station and the pumping station be drained so as to prevent the formation of a pool of stagnant water.
3. That the officials of the village of Smyrna consider the necessity of providing for the disposal of the sewage of the whole village and that they engage the services of a competent sanitary engineer to draw plans for a comprehensive and modern sewer system which shall be submitted to this Department for approval. Such procedure is in accordance with the village law relating to sewerage, and whereas, any system proposed should make proper provision for all parts of the village ultimately to be sewered, it will be possible and feasible to build at present, subject

to the approval of the State Commissioner of Health, only that portion of the works which are necessary from the standpoint of health and economy.

4. Whereas, the installation and careful operation of a system of well-designed sanitary sewers would remove the constant danger of the contamination of the water supply well from the more concentrated sewage and household wastes, nevertheless, since owing to the location and elevation of this well with reference to the surrounding topography and in a comparatively well-populated village, the water supply is subject to a greater or less amount of accidental pollution, I recommend that strict supervision be kept over this supply and that occasional analysis be made of the water by the village as an indication of its sanitary quality.

From the report of Dr. Brooks it appears that recommendation No. 2 only has been acted upon.

At the time of his inspection Dr. Brooks collected samples of the water from the supply and the result of the analyses of these samples together with others made in the past by the Division of Laboratories and Research will be found in the appended table.

These analyses show a clear, colorless and very hard water. The figures for nitrogen in its different forms are variable and in some cases are higher than should be found in an uncontaminated ground water supply. The figures for oxidized nitrogen in the form of nitrates and for chlorine are also very high and variable, thus indicating strongly the probability of pollution of the ground water sources tributary to the supply. The total bacterial counts are variable and are in some cases excessive, while the occurrence of fecal organisms of the B. coli type indicates active contamination of animal or human sources.

In view of the above facts, the following conclusions may be drawn:

1. That apparently the village authorities of Smyrna have not carried out in full the recommendations of this Department relative to improvements in their water supply.

2. That the present supply of the village derived from the well near the railroad, is undoubtedly, receiving the polluted ground water drainage from the village.

3. That it is very possible that at some time active infection of the supply may occur and that this infection may cause an outbreak of typhoid fever in thte village.

I would, therefore, recommend:

1. That the village authorities either carry out the recommendations of this Department relative to the proper disposal of wastes by the construction of adequate sewerage, or abandon completely the present supply and secure a new water supply of unquestionable sanitary quality and adequate quantity.

2. That pending the carrying out of the above recommendations the village install and operate suitable apparatus for the sterilization of their present supply with liquid chlorine.

Respectfully submitted,

THEODORE HORTON,
Chief Engineer

ALBANY, N. Y., *November 20, 1915*

RESULTS OF WATER ANALYSES

Abbreviations used to describe odors of water: 0, none; 1, very faint; 2, faint; 3, distinct; 4, decided; 5, strong; 6, very strong; a, aromatic; d, disagreeable; e, earthy; f, fishy; g, grassy; m, musty; v, vegetable

Municipality	County	Source of sample	Date of collection	Physical				Chemical (Parts per Million)												Bacteriological			
						Odor		Solids			Nitrogen as—						Hardness				B. Coli Type + = present — = absent		
				Color	Turbidity	Cold	Hot	Total	Loss on ignition	Mineral residue	Free ammonia	Albuminoid ammonia	Nitrites	Nitrates	Oxygen consumed	Chlorine	Total	Alkalinity	Bacteria per c.c.; gelatin 20°, 48 hours	10 c.c.	1 c.c.	1-10 c.c.
Smyrna	Livingston	Tap, public supply	2/18/11	Tr.	Cl.	....	....	295	100	195	.016	.064	.030	3.20	1.20	25.3	71.4	163.0	275	—	—	—
Smyrna	Livingston	Tap, public supply	3/27/11	Tr.	Cl.	....	....	298	37	261	.002	.012	.003	2.80	0.10	19.5	190.0	189.0	2,300	—	—	—
Smyrna	Livingston	Tap, public supply	4/24/11	Tr.	Cl.	....	....	295	56	239	.028	.054	.020	3.20	0.20	27.5	180.0	171.0	140	—	—	—
Smyrna	Livingston	Tap, public supply	6/ 8/11	Tr.	Cl.	....	....	366	86	280	.012	.046	.001	1.80	0.80	32.5	228.5	293.0	70	—	—	—
Smyrna	Livingston	Tap, public supply	9/ 8/11	3	Cl.	....	....	394	85	309	.006	.030	Tr.	3.20	0.80	26.0	250.0	225.0	75	+	+	—
Smyrna	Livingston	Tap, public supply	11/18/11	Tr.	Cl.	....	....	289	77	222	.020	.092	.001	3.20	0.50	27.0	214.5	208.0	30	—	—	—
Smyrna	Livingston	Tap, public supply	1/ 5/12	Tr.	Cl.	....	....	308	29	277	.024	.040	.003	4.00	0.30	20.0	191.4	186.0	30	—	—	—
Smyrna	Livingston	Tap, public supply	2/17/12	Tr.	Cl.	....	....	388	58	330	.006	.036	Tr.	5.20	0.50	42.0	364.5	217.0	20	—	—	—
Smyrna	Livingston	Tap, public supply	3/27/12	Tr.	Cl.	....	....	311	46	265	.004	.004	.002	4.80	0.30	16.8	208.0	183.0	40	+	—	—
Smyrna	Livingston	Tap, public supply	5/ 2/12	Tr.	Cl.	....	....	301	44	257	.004	.038	.001	4.80	0.10	18.0	171.4	158.0	350	—	—	—
Smyrna	Livingston	Tap, public supply	9/13/12	Tr.	Cl.	....	....	530	20	510	.002	.006	Tr.	4.80	0.40	35.0	300.0	217.0	375	+	—	—
Smyrna	Livingston	Tap, public supply	10/23/12	Tr.	Cl.	....	....	380	55	325	.010	.020	Tr.	4.40	0.60	29.8	235.5	219.0	300	—	—	—
Smyrna	Livingston	Tap, public supply	12/ 4/12	Tr.	Cl.	....	....	371	79	292	.008	.052	.001	6.00	0.80	24.8	214.5	208.0	80	—	—	—
Smyrna	Livingston	Tap, public supply	1/15/13	Tr.	Cl.	....	....	313	....	....	.016	.032	Tr.	6.00	0.60	20.8	208.0	201.0	70	—	—	—
Smyrna	Livingston	Tap, public supply	2/12/13	Tr.	Cl.	....	....	313	....	....	.006	.024	Tr.	5.00	0.90	17.0	201.5	177.0	110	—	—	—
Smyrna	Livingston	Tap, public supply	3/26/13	Tr.	Cl.	....	....	310	....	....	.024	.036	.001	3.50	0.30	21.8	201.5	194.0	60	—	—	—
Smyrna	Livingston	Tap, public supply	5/17/13	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	120	+	+	—
Smyrna	Livingston	Tap, public supply	6/25/13	Tr.	Cl.	....	....	388	....	....	.004	.016	.001	3.40	0.20	29.3	235.5	208.0	150,000	—	—	—
Smyrna	Livingston	Tap, public supply	5/ 4/14	Tr.	Tr.	1 v.	1 v.	278	65	213	.012	.022	Tr.	6.00	0.90	15.3	174.2	151.0	150	+	—	—
Smyrna	Livingston	Stream	8/26/15	....	....	....	....	....	....	....	....	....	....	....	....	1.0	....	....	*18,000	3+0—	3+0—	2+1—
Smyrna	Livingston	Tap, public supply	8/26/15	Tr.	Cl.	1 v.	1 v.	446	150	296	.004	.016	.025	4.00	0.40	15.0	228.5	210.0	*400	1+2—	0+2—	0+2—

* Ice melted.

SONYEA (Craig Colony for Epileptics)

At the request of the State Architect, a representative of this Department was detailed to visit Sonyea in order to be present at the running of a test on the new water softening and purification plant of the Craig Colony for Epileptics.

These tests were made on April 28 and 29, 1915. Several tests were made upon the filters to determine the accuracy of the flow recording gauges, control apparatus and general mechanical fitness of the plant. Observations were made as to the rate of application of the various chemicals and samples of raw and treated water and of the chemical solutions were collected and sent to the Division of Laboratories and Research for analysis. Upon the completion of the analysis of these samples a letter was sent to Hon. Lewis F. Pilcher, State Architect, in which it was stated that unsatisfactory results had been obtained in the purification process due to the insufficient strength of the softening chemicals used. It was recommended that another test be made with chemicals of proper strength. It was also recommended that certain improvements be made in the arrangements of the chemical feed apparatus.

A second test on the purification plant was made on October 8 and 9 at which a representative of this Division was again present. As at the time of the first test, samples of raw and treated water were collected as well as samples of the chemical solution.

The results of the analyses of the samples showed that comparatively efficient softening of the Keshequa creek water was being obtained.

In a letter to Mr. Pilcher it was suggested that the institution authorities make daily tests of the water in order to secure proper operation of the plant and that they should be cautioned to secure and maintain chemicals of good grade and full strength.

SOUTHAMPTON

HERMANN M. BIGGS, M.D., *State Commissioner of Health:*

An investigation of the public water supply of Southampton was made by Mr. C. M. Baker, assistant engineer, on May 4, 1915.

Southampton is located in the county of Suffolk on the Montauk branch of the L. I. R. R. about 91 miles from New York city. The resident or winter population of the village is about 2,800 but during the summer months the population is increased to about 4,500 due to summer residents from the city.

The water supply is owned and operated by the Southampton Water Works Co. and is derived from wells from which the water is pumped into tanks under air pressure whence it is distributed through the main to consumers. The plant is located about one mile to the north of the village in the center of a plot of land containing about 40 acres. Ninety-seven per cent. or 98 per cent. of the population is served with the water. There is a total of 684 service taps of which 592 or 37 per cent. are metered. The maximum daily water consumption for the year 1914 occurred on August 11 and was 812,000 gallons, the minimum on December 26 was 204,400 gallons. The average daily consumption for the year was 415,700 gallons corresponding to a per capita rate of approximately 125 gallons per day. The pressure usually ranges from 55 to 60 pounds but is increased during the summer to a minimum of 76 pounds.

There are three 8-inch and two 12-inch wells driven to a depth of 92 feet. The strata through which they pass consists of 8 feet of sand and clay near the surface and sand for the remainder of the distance. The water is drawn from the wells by means of two duplex Wellington pumps each having a capacity of 1,500,000 gallons daily. The pumps are located in a

pit 28 feet deep and the suction lift is about 4 feet, the level of the ground water thus being approximately 32 feet below the surface. There are three tanks with capacities of about 13,500 gallons each for the storage of water, and located above these are two others of the same capacity for air pressure purposes. The total storage available for water is thus approximately 40,500 gallons. The water mains consist of about 20 miles of pipe ranging from 4 to 8 inches in diameter.

Within a radius of one-quarter of a mile of the wells the density of population is approximately 50 per square mile and within one-half mile, 128 per square mile. Outside of this area and within the limits of the probable area of influence the population is approximately 76 per square mile. It is apparent that the wells are probably protected from sources of contamination in their immediate vicinity as there are no buildings within a distance of several hundred feet of the plant. The privy at the pumping station is provided with removable pails and it was apparent at the time of the inspection that they are being properly cared for.

Samples of the water for chemical and bacterial analyses were collected from the hydrant near the pumping station at the time of the inspection by the assistant engineer and later additional samples were collected by the health officer at the pumping station and various places throughout the village and sent to the Division of Laboratories and Research for analysis, the results of which are given in the appended table.

It is apparent from the analyses that the physical character of the water regarding color, turbidity and odor is satisfactory. The figures for free and albuminoid ammonia and nitrites are low, but, for nitrates the figures are comparatively high. The chlorine is probably not much in excess of the normal for the locality. The bacterial content was low in all but the later sample taken from the hydrant at the pumping station, in which it was 400 per c. c. The B. coli type was found present in all three of the 10 c. c. inoculations of this sample. One of the 10 c. c. inoculations of the previous sample taken at this place also shows the presence of B. coli. Organisms of this type were found present in only one of the 10 c. c. inoculations of the three other samples taken from the supply.

It is evident from the bacteriological analyses of the water taken from the hydrant at the pumping station that this water was badly contaminated; but the analysis of samples taken from other points in the system and also the sanitary condition in the vicinity of the wells indicate that the remainder of the supply was of a satisfactory quality at the time of the inspection. It is probable, therefore, that this contamination is due to some local pollution of the hydrant or pipes supplying it which does not affect the general supply. It is thus apparent that this particular place of sampling was unfortunately selected in that it does not represent the general condition of the supply and the results of the bacteriological analyses of these samples are therefore insignificant as regards the general supply, and it may therefore be concluded that the quality of the supply was satisfactory at the time of the inspection.

It would seem, however, that more frequent analyses should be made of the water to detect any contamination which may possibly exist and thus offer opportunity of locating and removing the sources of pollution or purifying the supply.

As a result of this investigation it is apparent that the water supply furnished by the Southhampton Water Works Company to the village of Southampton was of a satisfactory quality at the time of the inspection and that the company is taking proper precautions to guard the supply against pollution. It is apparent, however, that more frequent analyses of the water should be made in order to properly control the supply. I therefore beg to submit the following recommendations:

1. That the water company continue the maintenance of sanitary and satisfactory conditions in the vicinity of the wells and otherwise use all the precautions possible to adequately protect the supply.
2. That regular analysis of the water be occasionally made to detect any active contamination which may occur.

3. That should active contamination be found to occur at any time steps be immediately taken:

(a) To determine and eliminate the sources of such contamination if possible, or

(b) If it appears impracticable to eliminate the source of contamination the supply be sterilized with liquid chlorine.

(c) Should the above improvements fail to render the supply satisfactory new wells or other new supply free from any contamination be developed.

Respectfully submitted,

THEODORE HORTON,
Chief Engineer

ALBANY, N. Y., *June* 28, 1915

REPORT OF WATER ANALYSIS FOR SOUTHAMPTON

Source		Hydrant near pumping station	Hydrant near pumping station	Tap in pumping station	Tap in village	Tap in village
Collected on		5/11/15	5/29/15	5/29/15	5/29/15	5/29/15
Color		Trace	....	....	....	....
Turbidity		Clear	....	....	....	....
Odor, cold		1 v.	....	....	....	....
Odor hot		1 v.	....	....	....	....
Solids, total		58	....	....	....	....
Loss on ignition		7	....	....	....	....
Mineral residue		51	....	....	....	....
Ammonia, free		.002	....	....	....	....
Ammonia, albuminoid		Trace	....	....	....	....
Nitrites		.001	....	....	....	....
Nitrates		1.20	....	....	....	....
Oxygen consumed		0.50	....	....	....	....
Chlorine		13.75	....	....	....	....
Hardness, total		19.50	....	....	....	....
Alkalinity		6.00	....	....	....	....
Bacteria per c. c.		30	400	35	25	10
B. coli type	10 c. c.	1+2—	3+0—	0+3—	0+3—	1+2—
	1 c. c.	0+3—	1+2—	0+3—	0+3—	0+3—
	1/10 c. c.	0+3—	0+3—	0+3—	0+3—	0+3—

Results are expressed in parts per million. + Present. — Absent.
Abbreviations used to describe odors of water: 0, none; 1, very faint; 2, faint; 3, distinct; 4, decided; 5, strong; 6, very strong; a, aromatic; d, disagreeable; e earthy; f, fishy; g, grassy; m, musty; v, vegetable.

SPENCERPORT

HERMANN M. BIGGS, M.D., *State Commissioner of Health:*

An investigation of the public water supply of the village of Spencerport was made on September 8, 1915, by Mr. Morton F. Sanborn, assistant engineer.

The inspector was assisted at the time of the inspection by the president of the village, Mr. Elwood D. Hawkins; superintendent of the water works, Mr. John Ballard and the health officer of the village, Dr. L. E. Slaton.

Spencerport is an incorporated village located about 10 miles west of Rochester and about 10 miles from Lake Ontario. It is in the northwestern part of the town of Palma in the western part of Monroe county. The Niagara Falls line of the N. Y. C. & H. R. R. R., the Buffalo, Lockport & Rochester electric road and the Barge canal pass through the village. The population at present is about 1,000.

The public water supply is owned by the village and is under the control of the village officials. The water is used for household purposes and for

fire protection. The works were designed by Morrison & Farrington, civil engineers of Syracuse, and were constructed by Mr. F. R. Lewis of Ilion in 1912 under the direction of the engineers.

The water is obtained from a well located in a sand and gravel pit about 1¼ miles southwest of the village. The natural drainage from this well would be to Northrup creek and Lake Ontario. From the well the water is pumped at a nearby pumping station to the distributing main and to the water tank located about half way to the village. About 750 of the inhabitants or 75 per cent. of the total population are served by this supply. No definite figures of the daily water consumption could be obtained but estimated from the time of operation and capacity of the pumps the total consumption is about 45,000 gallons per day corresponding to 60 gallons per capita. There are 4½ miles of water mains varying in size from 4 to 10 inches. Fire protection is provided by hydrants placed in various parts of the village. The average pressure in the village is about 75 pounds per square inch.

There is no sewage system or method of sewage disposal in the village except individual cesspools and septic tanks.

The well is located in a gravel pit and is 12 feet in diameter and 18 feet deep. At the time of the inspection the well held about 11 feet of water. On the surface of the water there was a slight oily scum, due probably, to leakage of oil from the pumping station or possibly, to oil from the marsh land about ½ mile distant. This well is covered with a timber roof.

The pumping station which is a wooden structure about 18 by 36 feet in plan, is located immediately north of the well. The pumping plant is in duplicate and consists of two Rumsey triplex plunger pumps of 8-inch diameter and 10-inch stroke with a rated capacity of 250 gallons per minute each. Each pump is operated by an 18 horsepower Dubois gasoline engine. The pressure at the pumping station with the tank full of water is 55 pounds per square inch and with one of the pumps in operation the pressure is increased to about 58 pounds. The tank is located on a small hill about half way to the village and is about 25 feet in diameter and 28 feet high. This tank is elevated some distance above the ground in order that sufficient pressure may be obtained in the village. The tank has a capacity of about 100,000 gallons, equivalent to two days' supply.

There is practically no surface watershed above the well although the area from which the well may draw water is approximately ½ square mile. The well is located at the base of a small hill on the other side of which there is considerable swampy land which is probably somewhat higher than the level of the well. It is thought by the water officials that the drainage from this swamp percolates through the ground and reaches the well and at times, especially during the fall season, caused considerable odor and taste to the water. The soil is generally sand and gravel with a small amount of clay. No rock is exposed in the neighborhood but the underlying rock is probably of a sandstone or limestone formation.

There are no houses above the well although the land surrounding the well is used occasionally for pasturing sheep and cattle. This undoubtedly causes considerable pollution of the soil by animal excreta and the entire area surrounding the well should be fenced in order that the sheep and cattle may not enter upon this area. Considerable oil was seen on the floor of the engine room. It was stated that the packing in the pumps leaked so that oil might enter the water through this leaky packing. Considerable oily wastes have also been thrown on the ground outside of the pumping station and undoubtedly some of the oil from these wastes could percoluate into the well.

At the time of the inspection a sample of the water was collected from the tap in the village and the results of the analysis of this sample together with those previously made by the Division of Laboratories and Research will be found in the appended table.

These analyses show a water usually colorless and clear and very hard. At times the odors are marked. The figures for nitrogen in its various forms indicate the presence of decomposing and decomposable organic matter in

amounts somewhat greater than are usually found in ground waters adequately protected from mixture with surface waters. The total bacterial counts, also are somewhat high although fecal organisms were not found in any of the samples except that collected at the time of the inspection. In view of the surroundings of this well it seems probable that a fairly rapid infiltration of surface water into the well occurs at times, this surface water carrying with it organic pollution of animal origin from the pastures in the vicinity. The occasional occurrence of tastes and odors may be due to the development of vegetable aquatic growth in the well and water tank, or to the seepage of surface water laden with vegetable organic matter.

In view of the above facts, the following conclusions may be drawn:

1. That the public water supply of Spencerport is of reasonably satisfactory, sanitary quality although at times a certain amount of active contamination of animal origin is caused by the infiltration of surface water from the adjacent pasture lands.
2. That the physical quality of the water is depreciated by its extreme hardness and at certain times of the year by tastes and odors.
3. That the leaking of oil upon the floor of the pumping station and the disposal of oily wastes in the vicinity of the well probably causes a considerable amount of oil to reach the water.

I would, therefore, recommend:

1. That the village authorities secure control of the level area in the vicinity of the wells, fencing off this area in order to prevent the pasturing of cattle in the vicinity of the well.
2. That the village consider the question of the removal of tastes and odors from the water securing the advice of a competent expert to study the matter and devise a remedy. In this connection it would be well to study the practicability of aeration.
3. That the water works officials take steps at once to prevent the leaking or percolation of engine oil into the well.

Respectfully submitted,

THEODORE HORTON,

Chief Engineer

ALBANY, N. Y., *October* 8, 1915

RESULTS OF WATER ANALYSES

Abbreviations used to describe odors of water: 0, none; 1, very faint; 2, faint; 3, distinct; 4, decided; 5, strong; 6, very strong; a, aromatic; d, disagreeable; e, earthy; f, fishy; g, grassy; m, musty; v, vegetable

Municipality	County	Source of sample	Date of collection	Physical				Chemical (Parts per Million)											Bacteriological			
						Odor		Solids			Nitrogen as—						Hardness			B. Coli Type (+ = present, — = absent)		
				Color	Turbidity	Cold	Hot	Total	Loss on ignition	Mineral residue	Free ammonia	Albuminoid ammonia	Nitrites	Nitrates	Oxygen consumed	Chlorine	Total	Alkalinity	Bacteria per c.c.; gelatin 20°, 48 hours	10 c.c.	1 c.c.	1-10 c.c.
Spencerport	Monroe	Well	10/29/12	5	Tr.	3 a.	3 a.	186	15	171	.004	.042	Tr.	0.02	0.80	3.75	137.2	127.0	......	......	......	......
Spencerport	Monroe	Tap at house near well	11/19/12	10	Tr.	2 a.	2 a.	189	10	179	.028	.028	.010	0.06	1.30	2.75	148.6	122.0	4,100	—	—	—
Spencerport	Monroe	Tap in village	1/ 7/13	Tr.	Cl.	3 a.	3 a.	221	....	....	.022	.032	.001	0.20	0.70	3.50	137.2	127.0	40	—	—	—
Spencerport	Monroe	Tap in village	2/28/13	Tr.	Cl.	1 v.	1 v.	224	....	....	.008	.101	Tr.	0.24	1.00	3.50	154.2	128.0	190	—	—	—
Spencerport	Monroe	Tap in village	4/11/13	2	Tr.	1 v.	1 v.	229	....	....	.018	.032	.001	0.46	0.90	4.75	145.8	129.0	......	—	—	—
Spencerport	Monroe	Tap in village	5/29/13	Tr.	Tr.	2 a.	2 a.	297	....	....	.006	.012	.005	0.26	1.00	3.25	137.2	134.0	1,400	—	—	—
Spencerport	Monroe	Tap in village	7/17/13	Tr.	Tr.	1 a.	1 a.	206	....	....	.010	.032	.010	0.02	1.40	3.50	148.6	134.0	......	—	—	—
Spencerport	Monroe	Tap in village	9/ 8/15	Tr.	Tr.	1 v.	1 v.	220	25	195	.002	Tr.	.001	0.16	3.00	4.25	130.0	128.0	350	3+0—	2+1—	0+3—

STAATSBURG

Hermann M. Biggs, M.D., *State Commissioner of Health:*

An investigation of the public water supply of the village of Staatsburg was made on August 18, 1915, by Mr. M. F. Sanborn, assistant engineer, assisted at the time by Dr. James M. Cronk, health officer of the town of Hyde Park, Mr. S. N. White, superintendent of water company and Mr. Timothy Herrick, president of the company.

Staatsburg is an unincorporated village in the northern part of the town of Hyde Park on the east bank of the Hudson river. It is about 11 miles north of Poughkeepsie and the N. Y. C. and H. R. R. passes through the village. The population was estimated at about 400 at the time of the inspection.

The public water supply is furnished by the Staatsburg Water Company and the water is used for domestic purposes and for fire protection. The original works which consisted of a reservoir and pipe line, were designed by Meiklebam & Dinsmore, civil engineers and were constructed in 1909. The reservoir was constructed by day work and the pipe line by contract work. A filtration plant was designed by the same engineers and was constructed by day work in 1913.

The water is obtained from a small creek which enters the Hudson river about one mile below Staatsburg and an artificial reservoir about one mile east of the village was formed by the construction of a concrete dam. The water from this reservoir flows to the sand filters and thence to the filtered water reservoir and distributing system. There are about four miles of water mains varying in size from 4 to 10 inches. The water is distributed by gravity throughout the village and the average pressure is about 88 pounds.

About 60 per cent. of the population or 240 people are served by the water supply. There are no meters installed in the village nor was there any way in which the consumption could be obtained. It is probable that the per capita daily consumption would be somewhat above 100 gallons, and this figure would give a total consumption of about 24,000 gallons.

There is no sewerage system or method of sewage disposal in the village except local cesspools and septic tanks.

The reservoir is about 3 acres in size. When the surface of the water is at an elevation of 2 feet above the spillway the reservoir contains about 28,000,000 gallons, when flush with the spillway it contains about 20,000,000 gallons, when 5 feet below the spillway it contains about 4,000,000 and when 10 feet below the spillway the reservoir is practically empty. The capacity of the reservoir when full is equivalent to one year's supply although there is considerable leakage through the dam which would reduce considerably the length of time that the reservoir would supply water to the village.

The filters are of the slow sand type and are covered and the plant is constructed entirely of concrete. There are two units, each one being about 18 feet by 60 feet in plan. On the bottom of the filters was first placed the underdrains which consist of ½ round, 10 inch, bell and spigot, tile pipes. Around and above this pipe, there are about 18 inches of gravel graded from 1 inch to ⅛ inch in size. The filtering sand consists of 2½ to 3 feet of sand having an effective size of .26 mm. and a uniformity coefficient of 2.7. Both filters are kept in operation and the elevation of the water above the filters is regulated by a butterfly valve which controls the flow of water so as to maintain a constant elevation. The depth of the water above the filter sand was about 4 feet 3 inches.

Connected with the filters on the north end is the clear water reservoir which is 36 by 26 feet in plan. At the time of the inspection this reservoir contained 7½ feet of water and on the surface of the water there was an oily scum due to the oil from the vegetation. The maximum depth in this reservoir before the water starts to overflow is about 8 feet. The capacity of the reservoir when full would be about 50,000 gallons. This clear water reservoir is connected directly to the mains and acts as an equalizing reservoir

for the varying consumption during the 24 hours of the day. A float gauge is erected over this reservoir and the minimum depth allowed in the clear water reservoir before cleaning the filters is about 4½ feet. There is no device for controlling or regulating the loss of head and this loss of head depends both upon the clogged condition of the sand and upon the consumption as the water is drawn from the clear water reservoir. At the time of the inspection this loss of head amounted to about 2 feet. When the gauge of the clear water reservoir indicates a loss of head of 4 or 4½ feet one of the filters is cut out of use and about ½ inch of the sand from the surface of the filter is removed and placed outside on the ground.

After about 6 inches of the sand has been removed the entire quantity of sand is then washed and replaced on the surface of the filters. The washing of the sand is done by shovelling the same into a shallow inclined trough containing flowing water. The sand is agitated and most of the dirt is thus removed from the sand and washed away, while the washed sand is placed in a pile and later replaced upon the filters. After cleaning the filters the first water filtered is discharged into a clear water reservoir and is used with the water from the other filters. The filters are cleaned about once a week.

The area of the watershed above the dam is about .55 of a square mile and has a total population of about 40. This would correspond to a population per square mile of about 73. The watershed is comparatively flat and probably as much as 50 per cent. of the same is swamp land. This results in giving a high color to the water as well as considerable suspended matter due to the decaying vegetation from the swamps. The reservoir also contains considerable organic growths which were plainly seen in the water. The intake from the reservoir is located in a gate chamber about 20 feet from the face of the dam and about 15 feet below the surface which is below the general level of the bottom of the reservoir. This depth of the intake in the pond naturally causes the decaying vegetation on the bottom to be carried into the effluent pipe and to the filters. If provision were made for drawing water from a depth of say 5 feet below the surface the water would probably contain much less suspended matter. The watershed is gone over two or three times a year by the health officer and by the superintendent of the water company and any cases of pollution found are stopped. No cases of pollution were observed at the time of the inspection although there might be a small amount from cultivated and pasture land.

Analyses of this supply have been made occasionally in a laboratory at Poughkeepsie. At the time of the inspection the raw water was highly colored and contained considerable suspended matter. The filtered water was clear although it still had a high color.

At the time of the inspection samples of the raw water and of the filtered water were obtained and the results of the analyses are shown in the appended table.

The raw water had a very high color, 3 parts turbidity and considerable suspended matter. Nitrogen in its various forms was low except in the albuminoid ammonia which was quite high due to the coloring matter. The oxygen consumed was quite high also due largely to the coloring matter and suspended matter from the swamps.

The water contained considerable solids, was moderately hard and contained a considerable amount of iron. The bacterial count was high and those of the B. coli type were found in 1 c. c. samples showing some pollution of the water.

The filtered water although free of turbidity, had a color almost as great as that of the raw water. The various tests for nitrogen, with the exception of the albuminoid ammonia, gave nearly the same results as that found in the raw water while the albuminoid ammonia was reduced from 186 to 102 parts. The total solids were reduced to 45 parts and the total hardness 18.5 parts and this reduction was due largely to the removal of the decaying vegetation which was in suspension in the raw water.

The bacterial count in the samples of filtered water taken at the railroad station was very low although bacteria of the B. coli type were found in one of the 1 c. c. samples. This reduction of bacteria showed a very good percentage of removal.

The sample taken at the clear water reservoir gave poorer results than the sample taken at the station and this was undoubtedly due to the still water near the surface and to the oily scum on the same.

As a result of this investigation and of the analyses the following conclusions may be drawn:

1. That the filtered water was in general satisfactory from a sanitary standpoint although from the esthetic standpoint there was considerable color which could only be removed by special treatment.
2. That the raw water showed some pollution and was highly colored, due to the large proportion of swamp land, on the watershed and to the organic growth in the reservoir.
3. That the filters apparently removed a large part of the suspended matter and nearly all of the bacteria although they are not efficient in removal of color from the water.
4. That the presence of excessive iron may at times cause trouble in the village especially for laundry work although the .2 parts found in the filtered water should not give trouble.
5. That the low position of the intake causes a large amount of decayed vegetation from the bottom of the reservoir to be carried into the intake pipe.

In view of the above conclusions I would make the following recommendations:

1. That the reservoir be cleaned and all vegetation from the same be removed.
2. That frequent inspections of the watershed be continued and any source of pollution be removed.
3. That provision be made for drawing water from the reservoir at a point about 5 feet below the surface.
4. Whereas, the quantity of color is unimportant from a purely sanitary standpoint and affects only the esthetic quality of the water, if it is considered important to remove this color it would seem that this could only be accomplished in two ways, viz.:
   (a) Draining sufficiently the swamp levels to prevent as far as possible, the contact of the water with the organic matter as leaves, grass and vegetation.
   (b) The substitution of mechanical filtration with the use of alum for the present method of slow sand filtration. The iron present in the water may cause complication in the operation of a mechanical filter and before steps are taken to change the present plant an expert should be employed to advise them as to the most efficient method to install.

Respectfully submitted,

THEODORE HORTON,
Chief Engineer

ALBANY, N. Y., *October* 18, 1915

REPORT OF WATER ANALYSIS FOR VILLAGE OF STAATSBURG

Source		Raw water filter plant, No. A	Clear water reservoir No. B	Tap at railroad station No. C
Collected on		8/19/15	8/19/15	8/19/15
Color		25	....	22
Odor, hot		2 v.	....	1 v.
Odor, cold		2 v.	....	1 v.
Turbidity		3	....	Clear
Solids, total		135	....	90
Loss on ignition		10	....	15
Mineral residue		125	....	75
Ammonia, free		.004	....	.002
Ammonia, albuminoid		.186	....	.102
Nitrites		Trace	....	Trace
Nitrates		0.16	....	0.16
Oxygen consumed		8.80	....	7.10
Chlorine		1.50	....	1.50
Hardness, total		91.40	....	72.90
Alkalinity		64.00	....	64.00
Iron		0.4	0.2	0.1
Bacteria per c.c.		800	80	10
B. coli type	10 c. c.	3+0—	3+0—	1+2—
	1 c. c.	1+2—	2+1—	0+3—
	1/10 c. c.	0+3—	0+3—	0+3—

Results are expressed in parts per million. + Present. — Absent.

Abbreviations used to describe odors of water: 0, none; 1, very faint; 2, faint; 3, distinct; 4, decided; 5, strong; 6, very strong; a, aromatic; d, disagreeable; e, earthy; f, fishy; g, grassy; m, musty; v, vegetable.

SUBURBAN WATER COMPANY OF SLINGERLANDS

HERMANN M. BIGGS, M.D., *State Commissioner of Health:*

An inspection of the public water supply furnished by the Suburban Water Company to the villages of Delmar, Slingerlands, New Scotland and New Salem, Albany county was made by Mr. M. F. Sanborn, assistant engineer, on September 24, 1915 as the result of a complaint received in regard to odors of the water and to dysentery which had developed at Delmar.

Mr. Sanborn was assisted at the time of the inspection by Dr. J. B. Washburn, health officer of the town of Bethlehem and Mr. A. S. Frazier, secretary and manager of the water company.

A full investigation of this supply was made by the Engineering Division in 1911 and the report of such investigation will be found on page 776 of the thirty-second annual report of this Department. The previous investigation was made as a result of a few cases of typhoid fever in the village of Delmar at that time.

The main supply of this company is obtained from springs located about one mile west of the village of New Salem near the base of the Helderberg mountains. The water from the springs flows into two small collecting basins and from the lower of these is delivered to the water mains and reservoir; the reservoir being located between the villages of New Salem and New Scotland.

An auxiliary supply is obtained from Albright Cold Spring in the eastern part of the village of New Scotland. The water from this spring flows into a small pond about 20 feet wide and 30 feet long. An intake is located in the lower end of this pond from which the water is pumped into the mains which pass through the nearby road. At the upper end of the pond there is a bench or rustic seat. Immediately in front of this bench there is an opening about 30 inches in diameter which apparently has been used in the past as a well. The nearest house to this spring is about 100 feet distant and is on the same property as that on which the well is located. A privy is located in a shed

in the rear of the house and some of the drainage from this privy may possibly percolate through the ground to the spring.

In the earlier report a full description of the water works will be found and the conditions at the time of the recent inspection were about the same as stated in the previous report. There are now about 1,000 people who are served by this supply and the average daily consumption as estimated from pumping records amounts to about 85,000 gallons per day which corresponds to a per capita consumption of from 80 to 90 gallons per day.

The previous report pointed out the liability of pollution at the main spring from cattle and the danger of pollution from the privy located near the Albright Cold Spring and made recommedations that these conditions be corrected. Shortly before the recent inspection cattle were found drinking from one of the collecting basins at the main spring and a fence was therefore, erected surrounding this property. Tracks of the cattle could plainly be seen in the ground above and below the water line of the upper collecting basin.

In the reservoir and at the Albright Cold Spring a considerable amount of chara was found growing and this plant is the cause of giving odors similar to that of hydrogen-sulphide. Chara sometimes called "Stonewort" is of a little higher order than the algae, although it is sometimes classed as such. This plant lives largely on the calcium carbonate present in the water, and is very brittle and rough and upon decaying gives off decidedly unpleasant odors. The plant has small orange colored bodies of antheridia and immediately above them are the oogonia. The oogonia are fertilized by spermatzoids from the antheridia, become detached from the plant and remain dormant on the bottom until spring, when they germinate and form new plants. A small amount of pond weed and other vegetation were also seen in the waters at the spring and reservoir.

At the time of the recent inspection samples of the waters from each of the two springs and from a tap in the village were obtained and the analyses of these together with others previously made by the Division of Laboratories and Research will be found in the appended table.

It will be seen from the analyses that the sample from the main spring contained a small amount of color, odor and turbidity and was very hard. The comparatively high figures for nitrogen in its various forms, together with the high figures for oxygen consumed and chlorine indicate that some organic pollution of the spring water had taken place. The number of bacteria was quite high and those of the B. coli type were found in one of of the 1/10 c. c. samples, these results indicating active contamination from animal or human sources. In view of the conditions around the collecting reservoir it seems probable that the contamination was due to cattle which had access to this basin.

The sample from Albright Cold Spring was practically clear and very hard. The various tests for nitrogen were low with the exception of the nitrites and nitrates. These latter two results gave evidence of considerable well oxidized organic pollution. The high oxygen consumed and chlorine tests also indicated the occurrence of past pollution. The numbers of bacteria were moderate although those of the B. coli type were present in 1 c. c. samples. The presence of intestinal organisms is evidence of active contamination which was probably caused by the privy located nearby or possibly by pollution received at the old well opening.

The sample from the tap in Delmar gave a moderate count for bacteria although B. coli were found in 10 c. c. samples. This water gave somewhat better results than either of the springs as shown by the reduction of B. coli. Since the water from the main spring was being used during the night and that from the Albright Cold Spring during the day, this sample of water might have been from either source or a composite sample of both and, therefore, little additional evidence is afforded by this analysis.

As a result of this investigation and of the analyses of the various samples of water collected, the following conclusions may be drawn:

1. That the two sources from which water may be obtained by the Suburban Water Company, if properly protected from all pollution,

should give a satisfactory water as considered from a sanitary standpoint, although somewhat hard due to the limestone through which the water passes.

2. That the presence of cattle which recently had access to the collecting basin at the main spring as determined during the inspection undoubtedly caused considerable pollution as is indicated by the results of analyses.

3. That the Albright Cold Spring is liable to contamination from the nearby privy. This supply is also open to accidental or wilful contamination by chance visitors to the rustic bench near the spring.

4. That the odors in the water were due chiefly to a vegetable growth called chara in the bottom of the reservoir and springs.

5. That the products of decay of the chara which caused the odors may also have been the cause of some of the dysentery in the village.

6. That the pond weed also found in the reservoir while probably not causing unpleasant odors would upon decaying cause a high organic content in the water.

As a result of the above conclusions I would recommend:

1. That the water company make every effort to prevent pollution by cattle or from other sources at the main spring and intake basins.

2. That the company move the privy in the rear part of the house near the Albright Cold Spring further from the spring and some distance down the opposite slope of the hill. The rustic seat at the spring should also be removed or fenced to prevent its use and the opening in the stone at the spring should be closed to prevent chance contamination.

3. That the company clean the reservoir and springs as soon as possible chiefly by pulling up all of the chara and pond weed, in order that the plants may not be left in the reservoir to decay and also that those seeds which have not dropped may be removed.

4. That the company regularly clean the reservoir and spring each summer before the vegetable growths reach maturity.

Respectfully submitted,

THEODORE HORTON,
Chief Engineer

ALBANY, N. Y., *November* 16, 1915

THERESA

HERMANN M. BIGGS, M.D., *State Commissioner of Health:*

A reinspection of the public water supply of Theresa was made on August 17, 1915, by Dr. B. R. Wakeman, sanitary supervisor of district "B." A previous investigation of this supply was made in 1911 by the Engineering Division, a full report of which will be found on page 781 of the thirty-second annual report of this Department.

The public water supply of Theresa is taken from the Indian river at a point about the center of the stream, some 300 feet above the middle dam. The description of the intake, pumping station and water works system in general remains practically the same as given in the previous report. The pumping equipment is privately owned but the remainder of the water works is owned and operated by the municipality.

The Indian river above the water works intake at Theresa has a total watershed area of 313 square miles. There are but two villages of any size located on the watershed above Theresa, namely, Antwerp, with a population of about 974 and Philadelphia with a population of about 842. The watershed on the whole, however, is comparatively sparsely populated and it is estimated that the total population upon the watershed is about 9,000 or an average of 22 per square mile. It is also estimated that of this population the sewage of some 1,100 people is discharged directly into the river at Philadelphia and Antwerp, in addition to the washings discharged from sugar factories and cheese factories. In the village of Theresa itself a sewer outlet discharges sewage into the mill pond from which the supply is obtained only a few hundred feet below the intake and about one quarter of a mile above the intake there are several houses which discharge sewage over a cliff of the river gorge into the stream.

It is claimed, however, that the contaminated condition of the supply is so well known locally that very little, if any, of it is used for drinking purposes, drinking water being obtained from numerous wells in the various parts of the village.

The earlier report emphasized the seriously contaminated condition of the public water supply and also pointed out that the use of drinking water from wells in a thickly settled village is attended with considerable danger due to the strong probability of their contamination and it was, therefore, recommended:

1. That the village trustees take immediate steps to provide all dwellings now discharging sewage into the river above the water works intake with a proper sewer to be a part of an approved sewer system.
2. That the village retain a sanitary engineer to thoroughly investigate the local conditions with a view to finding the best means of improving the water supply. Such an investigation would inquire into all the sanitary features of each plan and should include a careful consideration of the expediency of purifying the present supply or developing a new public supply from another watershed or from ground water sources.

From the report of Dr. Wakeman it appears that none of these recommendations has been carried out.

At the time of his inspection Dr. Wakeman collected samples of the supply and the results of the analyses of these samples together with others made in the past by the Division of Laboratories and Research will be found in the appended table.

These analyses show a very soft water, highly colored and at times turbid. The figures for decomposing and decomposable organic matter are comparatively high and the chlorine content is at times considerably above the normal for this region. The total bacterial counts are usually excessive and fecal organisms of the B. coli type are always present in 10 c.c., frequently in one c.c. and occasionally in 1/10 c.c. inoculations. These analyses show clearly the grossly contaminated and unsafe condition of the water supply.

SUFFERN

HERMANN M. BIGGS, M.D., *State Commissioner of Health:*

A reinspection of the public water supply of Suffern was made on October 27, 1914, by Dr. W. J. Denno, sanitary supervisor of district "F," and the following report is based largely upon information furnished by him or by data on file in this Department. A full investigation of this water supply was made by the Engineering Division in January, 1909, and the report of this investigation will be found on page 342 of volume II of the thirtieth annual report of this Department.

The water supply of this village is pumped from the Mahwah river in the eastern part of the village and from a point just above the dam forming Antrim lake. At the time of the previous investigation the water was strained through a gravel and charcoal strainer but otherwise subjected to no form of purification. Since December, 1911, however, the water has been treated with hypochlorite of lime and filtered by means of a pressure mechanical filter using sulphate of aluminum as a coagulant. The present population of the village is 2,900 and the daily water consumption is 170,000 gallons.

The purification system, designed by Alexander Potter, consulting engineer, consists of a pressure mechanical filter and automatic feed devices for the application of alum and hypochlorite of lime. The filter is a horizontal, iron cylinder, 8 feet in diameter and 20 feet long containing a 3 foot depth of sand and 8 inches of gravel over a strainer system of underdrains. The estimated capacity of the filter is about 460,000 gallons per 24 hours or approximately 130,000,000 gallons per acre per day. The sterilization apparatus consists of two hypochlorite solution tanks from which the solution is applied to the raw water in the pump well by means of automatic dipper arrangements operated by the pumps, the application being made in proportion to the rate of pumping. A third tank is used for dissolving the alum and from this tank the alum solution is fed to a small constant head orifice box and thence into the pump well. The hypochlorite is added at the rate of 8 pounds per million gallons or at approximately 0.3 parts per million of available chlorine. No data have been obtained as to the amount of alum applied nor as to the maximum rate of filtration.

The Mahwah river has a drainage area above the water works of about 20 square miles upon which is a resident population of about 1,500. This stream runs in a southwesterly direction at the foot of and parallel with the range of Ramapo mountains for over eight miles. Several small tributaries enter the river from the range and a number of larger tributaries enter it from the less mountainous country on the east.

That portion of the watershed which lies to the northwest of the river and which includes the side slopes of the mountains is largely uninhabited. The eastern portion of the watershed is devoted to agriculture and is comparatively thickly settled. Numerous dwellings and several small hamlets are located upon this section of the watershed which is consequently traversed by several highways.

It is evident that the activities connected with the occupation of this watershed by the large population both resident and transient renders active contamination of the river from both direct and indirect sources practically unavoidable. Furthermore, several houses of the village itself are located near Antrim lake above the water works intake. In order to protect the supply as much as possible from such direct and indirect contamination rules and regulations were enacted by this Department in 1912.

At the time of the previous inspection some 22 sources of direct pollution of the river or its tributaries were noted consisting of barnyards, manure piles and privies located upon or near the banks of the various streams. Upon the recent inspection it was found that of these sources of pollution some 11 or 12 had been removed or conditions remedied while the other sources remain practically the same as at the time of the earlier inspection. In addition to these sources of contamination there are 8 houses on the

shore of Antrim lake which are connected with leaching cesspools located from 5 to 70 feet from the edge of the lake. These cesspools are said never to require cleaning and it is very probable that the seepage from them through the coarse sand and gravel soil brings about some contamination of the lake. Of these 8 houses some 5 have privies with concrete vaults. It is said that these vaults sometimes become filled and overflow at which times the contents may be washed into the lake.

However, plans for a sewer system and sewage disposal plant for the village have recently been submitted to this Department for examination and approval. These plans provide also for sewers in the vicinity of Antrim lake although it is not planned to construct such sewers immediately. In passing upon these plans this Department has required that the sewers around the lake shall be constructed of cast iron in order to minimize the danger of leakage. Furthermore, as it will be necessary to pump the sewage from this section into the main sewer system, it has also been required that provision be made for duplicate pumping equipment as an additional precaution against overflow of sewage into the lake in case of accident. It would seem that little danger of contamination would exist from those houses near the shore of the lake and above the water works intake if the sewers around the lake are properly constructed and maintained and if the present leaching cesspools and privy vaults are abandoned. Suggestions were made to the village both before and subsequent to the approval of plans for sewers that the design be so revised as to permit of the early construction of sewers adjacent to Lake Antrim.

In the report of the previous investigation it was pointed out that with the large and increasing population upon the watershed there would exist an increasing amount of indirect pollution even though all sources of direct pollution were abated. It was, therefore, recommended that the local authorities strengthen the barriers against contamination of this nature either by purchasing or controlling the land adjacent to the water courses and thus eliminating all sources of pollution on the watershed or by installing a modern filter plant. It was also recommended that in case any difficulty was experienced in abating insanitary conditions application should be made to this Department for the enactment of rules and regulations for the sanitary protection of the water supply.

It appears then that the village authorities by installing the filter and hypochlorite treatment and by securing the enactment of rules and regulations have acted in accordance with the recommendations of this Department. However, it is evident from the inspection of Dr. Denno that although several sources of contamination have been removed, others which still exist contrary to the provision of the rules and regulations should be corrected in order that every precaution may be taken to safeguard the water supply.

Samples of the water were collected by Dr. Denno and the analyses of which made by the Division of Laboratories and Research together with others made in the past will be found in the appended table.

The analyses made prior to January, 1912, show the character of the untreated water while those made since that date indicate the quality of the treated water, unless otherwise stated. The insanitary quality of the raw water is clearly shown by the analyses, the total number of bacteria being high and organisms of the B. coli type being practically always present in quantities as small as 1 c.c. and often present in 1/10 c.c., present in 1 c.c. only occasionally and absent in 10 c.c. in the case of about one-third of the samples. The samples collected by Dr. Denno show some improvement in the treated water in respect to total numbers of bacteria but little improvement in respect to B. coli. The series of analyses indicates that the purification process has improved the quality of this water supply but not to the extent which would be expected from efficient operation.

Without a detailed study of the methods of operation and control of the filter plant it is impossible to state in just what particulars improvements should be made. However, it is quite possible in view of the comparatively high and varying organic content of the raw water that the amount of hypochlorites applied is insufficient to bring about complete sterilization.

In view of the foregoing facts the following conclusions may be drawn:

1. That the local authorities have taken commendable action in respect to the previous recommendations of this Department, both in the matter of installing a purification plant and in securing the enactment of rules and regulations for the sanitary protection of the source of water supply.
2. That, although considerable effort has apparently been made towards carrying out the provisions of the rules and regulations, several violations still exist which require abatement.
3. That the purification plant, while giving a much better quality of water than that obtained previous to its installation, is not operating as efficiently as is essential to adequately safeguard the sanitary quality of the water supply.

I would, therefore, recommend:

1. That the local authorities take such action as is prescribed in the provisions of the Public Health Law for the enforcement of the rules and regulations enacted by this Department in the instances where violations have not been abated.
2. That the local authorities employ a qualified expert to make a careful study of the methods of operation and control of the water purification plant in order to determine the cause of its somewhat low bacterial efficiency and to improve this efficiency. In this connection it might be advisable to increase the amount of hypochlorite used to 12 or 13 pounds per million gallons of water which would give about 0.5 parts per million of available chlorine, the exact amount, however, can be determined by trial and control analyses only.
3. That the village construct as soon as possible the sewers around Antrim lake as heretofore suggested by this Department.

Respectfully submitted,

THEODORE HORTON,
Chief Engineer

ALBANY, N. Y., *January* 29, 1915

RESULTS OF WATER ANALYSES

Abbreviations used to describe odors of water: 0, none; 1, very faint; 2, faint; 3, distinct; 4, decided; 5, strong; 6, very strong; a, aromatic, d, disagreeable; e, earthy; f, fishy; g, grassy; m, musty; v, vegetable

Municipality	County	Source of sample	Date of collection	PHYSICAL				CHEMICAL (PARTS PER MILLION)												BACTERIOLOGICAL			
						ODOR		SOLIDS			NITROGEN AS—						HARDNESS				B. COLI TYPE + = PRESENT − = ABSENT		
				Color	Turbidity	Cold	Hot	Total	Loss on ignition	Mineral residue	Free ammonia	Albuminoid ammonia	Nitrites	Nitrates	Oxygen consumed	Chlorine	Total	Alkalinity	Bacteria per c.c.; gelatin 20°, 48 hours	10 c.c.	1 c.c.	1-10 c.c.
Suffern	Rockland	Lake Antrim	4/16/09	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	10,500	+	+	+
Suffern	Rockland	Tap, in pump station	4/16/09	27	2	....	....	61	21	40	.016	.118	.001	0.04	6.30	2.62	23.4	19.0	10.500	+	+	+
Suffern	Rockland	Lake Antrim	6/16/09	5	1	....	....	102	41	61	.044	.140	.003	0.04	2.90	2.37	69.3	65.0	550	+	+	−
Suffern	Rockland	Tap, public supply	6/16/09	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	1,400	+	+	−
Suffern	Rockland	Tap, public supply	7/ 8/10	10	1	....	....	91	23	68	.018	.076	.001	0.10	1.75	2.50	67.1	67.0	43,600	+	−	−
Suffern	Rockland	Lake Antrim	7/ 8/10	10	1	....	....	97	27	70	.026	.086	.003	0.10	1.75	2.87	67.8	68.0	24.000	−	−	−
Suffern	Rockland	Tap, public supply	10/22/10	5	Tr.	....	....	102	22	80	.010	.070	.002	0.02	1.50	3.25	78.6	78.0	2,100	+	+	−
Suffern	Rockland	Lake Antrim	10/22/10	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	500	+	+	+
Suffern	Rockland	Tap, public supply	1/14/11	10	Cl.	....	....	66	19	47	.016	.090	.002	0.20	2.15	4.50	42.9	38.0	170	+	−	−
Suffern	Rockland	Lake Antrim	3/29/11	20	5	....	....	80	36	44	.016	.134	.004	0.10	3.30	2.88	41.6	41.0	2,500	+	+	−
Suffern	Rockland	Tap, public supply	3/29/11	20	5	....	....	83	44	39	.016	.102	.003	0.10	3.50	2.75	39.0	38.0	2,900	+	+	+
Suffern	Rockland	Lake Antrim	10/27/11	30	Tr.	....	....	86	27	59	.010	.090	.001	Tr.	4.30	3.37	44.3	29.0	2,600	+	+	−
Suffern	Rockland	Tap, public supply	10/27/11	30	Tr.	....	....	74	24	50	.008	.060	Tr.	Tr.	3.90	3.25	42.9	33.0	1,600	+	+	−
Suffern	Rockland	Tap, public supply	11/25/11	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	5,700	+	−	−
Suffern	Rockland	Tap, public supply	11/25/11	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	7,800	+	+	+
Suffern	Rockland	Lake Antrim	11/27/11	12	Tr.	....	....	88	11	77	.014	.058	.003	0.10	1.85	2.75	44.3	38.0	....	....	....	....
Suffern	Rockland	Tap, public supply	12/ 9/11	10	3	....	....	155	19	136	.024	.056	.002	0.80	0.50	5.50	100.0	93.0	1,300	+	+	−
Suffern	Rockland	Tap, public supply	1/24/12	Tr.	Cl.	....	....	87	14	73	.032	.042	.001	0.32	1.56	3.25	64.3	54.0	4,900	+	−	−
Suffern	Rockland	Tap, public supply	3/ 1/12	Tr.	Cl.	....	....	61	12	49	.030	.070	Tr.	0.26	2.60	2.75	31.2	31.0	13,000	+	+	−
Suffern	Rockland	Tap, public supply	4/ 3/12	Tr.	Cl.	....	....	69	8	61	.010	.026	Tr.	0.10	0.70	2.25	44.3	24.0	2,600	+	−	−
Suffern	Rockland	Tap, public supply	10/ 3/12	18	Cl.	....	....	113	36	77	.006	.048	Tr.	0.06	2.30	3.50	64.3	....	1,000	−	−	−
Suffern	Rockland	Tap, public supply	11/ 8/12	20	Cl.	....	....	100	28	81	.010	.088	.001	0.08	3.50	4.50	55.7	39.0	600	+	−	−

Suffern	Rockland	Tap, public supply	12/26/12	5	Tr.	....	....	91	27	64	.020	.068	Tr.	0.20	1.30	3.75	50.0	39.0	4,500	—	—	—
Suffern	Rockland	Tap, public supply	1/28/13	Tr.	Tr.	1 v.	1 v.	81	....	....	.014	.048	.001	0.24	1.40	3.50	54.3	37.0	10	—	—	—
Suffern	Rockland	Tap, public supply	3/10/13	Tr.	Cl.	1 v.	1 v.	88	....	....	.016	.040	.001	0.24	1.00	3.75	55.7	40.0	*	......	......	......
Suffern	Rockland	Tap, public supply	4/14/13	5	Cl.	1 v.	1 v.	66	....	....	.022	.062	Tr.	0.08	2.30	2.50	39.0	30.0	120	0+3—	0+3—	0+3—
Suffern	Rockland	Tap, public supply	5/26/13	15	2	2 v.	2 v.	87	....	....	.010	.084	.001	0.08	3.50	3.25	62.9	48.0	385	3+0—	2+1—	0+3—
Suffern	Rockland	Tap, public supply	7/ 7/13	8	Tr.	1 a.	1 a.	108	....	....	.004	.088	.002	0.14	1.80	3.50	67.1	60.0	*	3+1—	0+3—	0+3—
Suffern	Rockland	Tap, public supply	3/23/14	Tr.	Tr.	1 v.	1 v.	71	20	51	.030	.042	.001	0.20	1.50	3.25	44.3	29.0	60	0+3—	0+3—	0+3—
Suffern	Rockland	Antrim lake, west side	10/27/14	18	2	2 v.	2 v.	142	42	100	.012	.106	.003	0.04	4.50	5.38	84.3	82.0	140	3+0—	0+3—	0+3—
Suffern	Rockland	Antrim lake, east side	10/27/14	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	220	2+1—	0+3—	0+3—
Suffern	Rockland	Tap, public supply	10/27/14	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	65	2+1—	0+3—	0+3—

* Delayed in transit.

In view of the above facts the following conclusions may be drawn:

1. That the village authorities, apparently, have taken no action along the lines recommended by this Department.

2. That the present water supply of Theresa derived from the Indian river is unfit and unsafe for a public water supply.

I would, therefore, recommend:

1. That the village authorities give their immediate attention to the previous recommendations of this Department.

2. That, pending the installation of adequate purification facilities for the present supply or the securing of a new supply of unquestioned purity, the village install and operate a suitable apparatus for the sterilization of the water supply with liquid chlorine; this apparatus should at all times be carefully and efficiently operated under the supervision of a competent expert.

Respectfully submitted,

THEODORE HORTON,
Chief Engineer

ALBANY, N. Y., *September* 23, 1915

RESULTS OF WATER ANALYSES

Abbreviations used to describe odors of water: 0, none; 1, very faint; 2, faint; 3, distinct; 4, decided; 5, strong; 6, very strong; a, aromatic, d, disagreeable; e, earthy; f, fishy; g, grassy; m, musty; v, vegetable

Municipality	County	Source of sample	Date of collection	Physical				Chemical (Parts Per Million)											Bacteriological			
						Odor		Solids			Nitrogen as—						Hardness			B. Coli Type + = present — = absent		
				Color	Turbidity	Cold	Hot	Total	Loss on ignition	Mineral residue	Free ammonia	Albuminoid ammonia	Nitrites	Nitrates	Oxygen consumed	Chlorine	Total	Alkalinity	Bacteria per c.c.; gelatin 20°, 48 hours	10 c.c.	1 c.c.	1-10 c.c.
Theresa	Jefferson	Tap, public supply	2/13/12	40	5	....	....	140	70	70	.026	.102	Tr.	0.48	5.80	2.50	67.1	67.0	5,800	+	+	—
Theresa	Jefferson	Tap, public supply	3/16/12	35	Tr.	....	....	112	27	85	.022	.144	.002	0.36	4.00	2.25	70.0	69.0	4,000	+	+	—
Theresa	Jefferson	Tap, public supply	4/20/12	65	10	....	....	89	27	62	.006	.118	.001	Tr.	9.40	1.00	42.9	34.0	100	+	+	—
Theresa	Jefferson	Tap, public supply	9/ 9/12	25	Tr.	....	....	119	25	94	.002	.092	Tr.	0.16	3.90	2.12	60.0	59.0	25,000	+	+	—
Theresa	Jefferson	Tap, public supply	10/26/12	30	Cl.	....	....	104	22	82	.032	.184	Tr.	0.10	6.00	2.25	67.1	62.0	120	+	—	—
Theresa	Jefferson	Tap, public supply	12/ 9/12	45	10	....	....	81	26	55	.024	.108	Tr.	0.24	10.40	2.15	39.0	35.0	12,500	+	+	+
Theresa	Jefferson	Tap, public supply	1/11/13	40	15	....	....	96	....	....	.020	.120	.001	.026	5.20	1.50	35.1	36.0	2,000	+	+	—
Theresa	Jefferson	Tap, public supply	2/15/13	55	Tr.	....	....	96	....	....	.012	.100	Tr.	.024	7.00	0.87	50.0	40.0	200	+	—	—
Theresa	Jefferson	Tap, public supply	3/29/13	30	12	....	....	64	....	....	.014	.130	Tr.	.026	6.00	0.75	29.9	24.0	1,600	+	—	—
Theresa	Jefferson	Tap, public supply	5/10/13	40	1	....	....	87	....	....	.016	.114	.001	.008	6.60	1.50	50.0	47.0	....	......	......	......
Theresa	Jefferson	Tap, public supply	6/21/13	65	5	....	....	96	....	....	.016	.114	.001	.002	8.40	1.00	51.4	47.0	3,300	+	+	+
Theresa	Jefferson	Tap, public supply	7/26/13	30	3	....	....	100	....	....	.020	.136	.001	.004	3.70	2.25	62.9	58.0	....	+	—	—
Theresa	Jefferson	Tap, public supply	5/15/14	40	10	1 v.	1 v.	141	86	55	.020	.202	Tr.	0.08	38.4	0.50	41.6	33.0	70	+	—	—
Theresa	Jefferson	Tap, public supply	8/17/15	....	....	....	....	....	....	....	....	....	....	....	......	......	......	......	60	0+3—	0+3—	0+3—
Theresa	Jefferson	Tap, pumping station	8/17/15	....	....	....	....	....	....	....	....	....	....	....	......	......	......	......	150	2+1—	0+3—	0+3—
Theresa	Jefferson	Indian river	8/17/15	25	3	3 v.	3 v.	102	20	82	.036	.236	.003	0.14	9.50	0.75	48.6	44.0	130	3+0—	1+2—	1+2—

TREADWELL

HERMANN M. BIGGS, M.D., *State Commissioner of Health:*

An investigation of the public water supply of Treadwell was made on September 22, 1915, by Mr. C. M. Baker, assistant engineer, in company with Dr. C. C. Duryee, sanitary supervisor.

Treadwell is an unincorporated village located in the town of Franklin, Delaware county, about 9 miles south of the city of Oneonta. It is most conveniently reached by the D. & H. R. R. to Oneonta thence by conveyance to Treadwell. The population of the village is about 250.

The supply is owned by the Croton Water Company of which John Schemerhorn is president and superintendent, and is derived from springs located about ¾ of a mile southwest of the village. From the springs the water is conveyed by gravity to a concrete reservoir located near the village thence by gravity to the consumers. Practically all of the inhabitants of the village are served with the water. No definite information was available regarding the consumption as there are no meters nor other method of measuring the water used. Based, however, on a per capita rate of 100 gallons daily the average daily consumption would be 25,000 gallons. The pressure in the village ranges from 50 to 60 pounds per square inch.

The springs are located in a pasture on the side of a hill and just above the road leading from the village. A basin approximately 12 x 25 feet in area is formed by a concrete dam constructed just below the springs. This basin is enclosed by a fence located, however, only 4 or 5 feet from the water's edge. No drainage ditches are provided above the springs to divert the surface wash. The reservoir to which the water is conducted from the springs is constructed of concrete and is covered. It is 24 feet square by 7 feet deep and thus has a capacity of about 30,000 gallons.

The only building above the springs is a barn located about 300 feet distant, which, however, was apparently not occupied at the time of the inspection. There is, nevertheless, considerable opportunity for pollution of the water by surface wash from the surrounding pasture land. In fact the assistant engineer was informed that cattle had been seen frequently about the spring.

Samples of the water were collected from a tap in the village and sent to the Division of Laboratories and Research for analyses, the results of which are appended.

The results of the analyses indicate that the physical qualities of the water were satisfactory at the time the samples were collected. The figures for nitrates and chlorine, however, were above normal for the locality. The bacterial count was high and the B. coli type was present in all 3 of the 10 c. c. inoculations, thus indicating the presence of active contamination from animal sources. It is probable that this pollution is from cattle or other live stock in the vicinity of the springs since, as pointed out above, the springs are inadequately protected from surface wash.

As a result of this investigation it is apparent that the springs from which the public water supply of the village of Treadwell is derived are subject to considerable pollution by surface wash from the adjacent pasture land and by the cattle themselves. This fact is borne out not only by an inspection of the conditions in the vicinity of the springs but also by the results of analyses of samples of water collected at the time of the inspection.

In view of the above I beg to offer the following recommendations to be acted upon by the water company.

1. That a larger area of land about the springs be acquired and that a suitable fence enclosing this area be constructed at a sufficient distance from the springs and collecting basin to prevent pollution of the water by live stock in the vicinity.
2. That suitable drainage ditches be constructed to divert all surface wash from the springs and the collecting basin.

Respectfully submitted,

THEODORE HORTON,
Chief Engineer

ALBANY, N. Y., *December* 30, 1915

REPORT OF WATER ANALYSIS FOR TREADWELL

Source		Tap public supply
Collected on		9/22/15
Color		Trace
Odor, hot		1 v.
Odor, cold		1 v.
Turbidity		Clear
Solids, total		50
Loss on ignition		25
Mineral residue		25
Ammonia, free		.002
Ammonia, albuminoid		.018
Nitrites		.001
Nitrates		0.30
Oxygen consumed		2.20
Chlorine		0.50
Hardness, total		19.50
Alkalinity		15.00
Bacteria per c. c.		325
B. coli type	10 c. c.	3+0—
	1 c. c.	1+2—
	1/10 c. c.	0+3—

Results are expressed in parts per million. + Present. — Absent.
Abbreviations used to describe odors of water: 0, none; 1, very faint; 2, faint; 3, distinct; 4, decided; 5, strong; 6, very strong; a, aromatic; d, disagreeable; e, earthy; f, fishy; g, grassy; m, musty; v, vegetable.

TUPPER LAKE

HERMANN M. BIGGS, M.D., *State Commissioner of Health:*

A reinspection of the public water supply of Tupper Lake was made on November 19, 1914, by Dr. John A. Smith, sanitary supervisor of district "A," and the following report is based largely upon information furnished by him. A full investigation of this supply was previously made by the Engineering Division in November, 1908, the report of which will be found on page 312 of volume II of the twenty-ninth annual report of this Department.

The water supply of this village is derived from a storage reservoir fed by several small mountain streams, this reservoir being located about 3 miles south of the village. The water works are owned by the Tupper Lake Water Company and in addition to supplying the village itself, also serve the adjoining communities of Sears Hill, French Village and Tupper Lake Junction. The total population served by this supply at present is estimated at 5,500. The average daily water consumption is about 300,000 gallons of which 75,000 gallons are used by lumber mills. The water works system remains the same as described in the former report.

The watershed tributary to the reservoir consists of about 1 square mile of steep mountainous country with no population and no permanent source of contamination. Apparently the only contamination that might reach this source of supply would come from hunters, fishermen or other chance visitors upon this watershed.

At times, however, it becomes necessary to supplement the regular supply by water pumped from Simon pond; the pumping equipment being the same as in 1908. The watershed of this pond lies to the east of and adjacent to that of the regular supply. The area of the watershed of the pond is about 10 square miles, consisting of rough, hilly and wooded country. The habitations upon this watershed consist of two camps only. The privies of these camps are about 125 feet from the pond.

During the past summer water was pumped from Simon pond between

June 13 and August 15, the pumps being operated 20 days during this period. At the time of pumping there were complaints of sediment in the village supply. It seems probable that this turbidity was due to stirring up of accumulations of sediment in the water mains by the pumping.

Another source of water supply which has been used at times of emergency is Raquette pond upon which the village is located. The lumber mills have pumps which can pump directly from this pond into the village mains although this practice has been forbidden by the water company. On the night of November 17, 1914, one of the lumber mills was destroyed by fire and at that time the pumps in the engine room of one of the other mills pumped Raquette pond water into the village mains.

A large portion of the population of the village resides on or close to the shores of Raquette pond and as there is no village sewer system many houses and several large lumber mills sewer directly into this pond. The dangerous sanitary quality of the pond water is therefore evident.

The previous report upon this water supply pointed out the inadequacy of the regular source of supply and advised that the water company take steps to increase their supply either by obtaining some other satisfactory source or by developing Simon pond and protecting it from contamination. The occurrence of sediment in the mains was noted and more frequent and thorough flushing advised. The discontinuance of the practice of pumping water from Raquette pond into the mains was strongly urged and it was suggested that the water company consider the advisability of increasing the capacity of their pumping plant at Simon pond in order to afford ample fire protection.

It would appear, then, from the data obtained by Dr. Smith that the advice of the previous report has been neglected.

At the time of the recent inspection samples of water were collected from the regular supply and from Raquette pond and the results of the analyses of these samples by the Division of Laboratories and Research will be found in the accompanying table.

One or two analyses can show only the character of the water at the time of the collection of the samples and cannot with certainty indicate the quality of the water at all times and under all conditions. In the present instance the few analyses of the regular supply show a water, rather high in color and hardness, free from turbidity and with considerable decomposing and decomposable organic matter of vegetable origin. The figure for chlorine is that found normally in unpolluted water of this region. The bacterial counts in the samples of the regular supply are about the same as are found in uncontaminated surface supplies.

The single bacterial analysis of water from Raquette pond, confirms the view as to its dangerous sanitary quality. The total count is high and the presence of organisms of the B. coli type in inoculations as small as 1/10 c.c. indicates active and concentrated contamination of sewage origin.

In view of the above the following conclusions may be drawn:

1. That the regular water supply of Tupper lake is derived from a watershed free from permanent sources of contamination although, as is true of practically all surface supplies, open to possible contamination from chance sources such as hunters, fishermen or other visitors upon the watershed.

2. That the supply derived from Simon pond, although open to chance contamination, is free from permanent sources of contamination with the exception of the two camps noted in the report and, if properly developed and its quality protected by some form of sterilization with liquid chlorine or hypochlorite of lime, would probably afford a satisfactory as well as adequate supply.

3. That the practice of pumping from Raquette pond is highly dangerous due to the sewage pollution of the waters of this pond and whenever such pumping is resorted to there may occur a serious outbreak of typhoid fever.

I would, therefore, recommend:

1. That the water company consider at once the problem of securing additional water supply which shall be ample at all times and for all purposes and which shall be satisfactory both in quality and quantity.
2. That, in order to absolutely prevent the practice of pumping from Raquette pond by the mill pump into the village mains, all connections between these pumps and the mains be removed.

Respectfully submitted,

THEODORE HORTON,
Chief Engineer

ALBANY, N. Y., *January* 6, 1915

REPORT OF WATER ANALYSIS FOR TUPPER LAKE

Source		Tap, Tupper lake	Tap, Tupper lake junction	Reservoir	Raquette pond
Collected on		11/19/14	11/19/14	11/19/14	11/19/14
Color		10	....	....	....
Turbidity		Clear	....	....	....
Odor, cold		1 v.	....	....	....
Odor, hot		1 v.	....	....	....
Solids, total		75	....	....	....
Loss on ignition		22	....	....	....
Mineral residue		53	....	....	....
Ammonia, free		.044	....	....	....
Ammonia, albuminoid		.050	....	....	....
Nitrites		Trace	....	....	....
Nitrates		0.30	....	....	....
Oxygen consumed		7.20	....	....	....
Chlorine		0.38	....	....	....
Hardness, total		35.1	....	....	....
Alkalinity		9.0	....	....	....
Bacteria per c. c		250	10	750	8.600
B. coli type	10 c. c.	0+3—	0+3—	1+2—	3+0—
	1 c. c.	0+3—	0+3—	0+3—	3+0—
	1/10 c. c.	0+3—	0+3—	0+3—	3+0—

Results are expressed in parts per million. + Present. — Absent.

Abbreviations used to describe odors of water: 0, none; 1, very faint; 2, faint; 3, distinct; 4, decided; 5, strong; 6, very strong; a, aromatic; d, disagreeable; e, earthy; f, fishy; g, grassy; m, musty; v, vegetable.

TUXEDO PARK

HERMANN M. BIGGS, M.D., *State Commissioner of Health:*

A reinspection of the public water supply of Tuxedo Park was made on August 9, 1915, by Dr. C. W. Berry, sanitary supervisor, of district "N." A previous inspection of this water supply was made in 1911 by the Engineering Division, the report of which will be found on page 791 of the thirty-second annual report of this Department.

The water supply of Tuxedo Park is derived from Tuxedo lake, partly by pumping and partly by gravity and is supplied to practically all of the combined population of the park and the village. The intake for the village system extends about 300 feet from the outlet end of the lake, into a depth of water of 10 or 15 feet and is laid close to the bed of the lake. The water used in the park is pumped from a well 15 feet in diameter and 14 feet deep situated at the edge of the lake. The water flows into this well from the lake through an intake pipe extending out into the lake about 50 feet. The water works system remains practically the same as described in detail in the early report.

Tuxedo lake has a drainage area of 4.23 square miles with a total resident population on the watershed of about 150 per square mile during the summer. Transient visitors and workmen upon the watershed will increase this figure to about 300. There is practically little danger of a continuous or permanent pollution of the lake as all the houses are connected with a sewer system which delivers the sewage into a disposal plant below the outlet of the lake. There are, however, numerous opportunities for intermittent pollution of the water of the lake due to the use of the lake for boating, bathing and fishing, together with the possibility of accidental, incidental or wilful contamination by the numerous visitors and workmen visiting the lake and its vicinity. The opportunities for contamination of the lake remain exactly the same as described previously.

At the time of the earlier report the following recommendations were made:

1. That the Tuxedo Park Association arrange for the inspection and the repair, if found necessary, of the intake line for the village system and for the extension of both the village and park system intakes some few hundred feet further into the lake where the water is deeper and less subject to the influence of surface currents and surface wash.
2. That the Association apply to this Department for the enactment of rules under section 70 of the Public Health Law for the protection from contamination of the public water supply furnished by them.

From the report of Dr. Berry it appears that no attempt has been made to extend the intake pipe and although rules and regulations were prepared by this Department, these rules were not accepted by the association.

At the time of his inspection Dr. Berry collected samples of the water, the results of the analyses of which together with others made in the past by the Division of Laboratories and Research will be found in the appended table.

These analyses show a somewhat colored, slightly turbid and moderately soft water. The figures for nitrogen in its various forms indicate a moderate amount of decomposing and decomposable organic matter. The chlorine content is above normal for this region. The bacterial counts although moderate in some samples are rather high in others, and the occasional presence of fecal organisms of the B. coli type in samples as small as 1 c.c., indicates a certain amount of active contamination of animal or human origin.

In view of the above facts the following conclusions may be drawn:

1. That the Tuxedo Park Association has carried out none of the recommendations of this Department.
2. That the water supply furnished to Tuxedo Park is open to intermittent contamination of an accidental, incidental or wilful nature due to the large number of visitors to the lake or its vicinity during the summer.

I would, therefore, recommend:

1. That the association authorities give their immediate attention to the previous recommendations of this Department.
2. That the authorities provide and properly operate suitable apparatus for sterilization of the supply with liquid chlorine.

Respectfully submitted,

THEODORE HORTON,
Chief Engineer

ALBANY, N. Y., *November* 4, 1915

RESULTS OF WATER ANALYSES

Abbreviations used to describe odors of water: 0, none; 1, very faint; 2, faint; 3, distinct; 4, decided; 5, strong; 6, very strong; a, aromatic; d, disagreeable; e, earthy; f, fishy; g, grassy; m, musty; v, vegetable

Municipality	County	Source of sample	Date of collection	Physical				Chemical (Parts per Million)											Bacteriological			
						Odor		Solids			Nitrogen as—						Hardness			B. Coli Type + = present — = absent		
				Color	Turbidity	Cold	Hot	Total	Loss on ignition	Mineral residue	Free ammonia	Albuminoid ammonia	Nitrites	Nitrates	Oxygen consumed	Chlorine	Total	Alkalinity	Bacteria per c.c.: gelatin 20°, 48 hours	10 c.c.	1 c.c.	1-10 c.c.
Tuxedo	Orange	Tap, public supply	1/25/12	10	Cl.	....	....	38	14	24	.024	.110	.001	0.14	2.84	2.25	20.8	15.0	50	—	—	—
Tuxedo	Orange	Tap, public supply	2/29/12	Tr.	Cl.	....	....	30	9	21	.022	.096	Tr.	0.08	2.20	2.25	19.5	15.0	210	+	—	—
Tuxedo	Orange	Tap, public supply	4/ 3/12	15	Tr.	....	....	42	15	27	.006	.082	Tr.	0.04	2.20	2.50	22.1	13.0	60	—	—	—
Tuxedo	Orange	Tap, public supply	10/ 3/12	10	Tr.	....	....	49	18	31	.006	.006	.001	0.64	2.80	2.00	22.1	14.0	8,200	+	—	—
Tuxedo	Orange	Tap, public supply	11/ 8/12	10	Cl.	....	....	38	11	27	.012	.112	.001	0.06	1.90	2.25	23.4	15.0	....	+	+	—
Tuxedo	Orange	Tap, public supply	3/12/13	8	2	....	....	56	....	....	.008	.074	.001	0.06	3.20	2.75	32.5	13.0	30	—	—	—
Tuxedo	Orange	Tap, public supply	4/16/13	15	5	....	....	47	....	....	.024	.154	.001	0.08	3.20	2.50	26.0	14.0	1,100	—	—	—
Tuxedo	Orange	Tap, public supply	5/28/13	15	5	....	....	49	....	....	.020	.114	.001	0.04	3.70	2.25	20.8	13.0	475	+	—	—
Tuxedo	Orange	Tap, public supply	7/10/13	15	3	....	....	49	....	....	.004	.118	.001	0.04	2.60	2.75	22.1	14.0	....	+	—	—
Tuxedo	Orange	Tap, public supply	3/24/14	5	Tr.	1 v.	1 v.	43	13	30	.008	.068	.001	0.06	2.90	2.75	23.1	14.0	200	—	—	—
Tuxedo	Orange	Tap, public supply	8/ 9/15	Tr.	Tr.	1 a.	1 a.	34	8	26	.004	.045	.001	0.02	2.30	2.50	24.7	16.0	*9,300	2+1—	2+1—	0+3—
Tuxedo	Orange	Intake	8/ 9/15	....	....	....	....	....	....	....	....	....	....	....	....	......	......	......	*38,000	3+0—	3+0—	0+3—

* 2 days in transit.

UNIONVILLE

HERMANN M. BIGGS, M.D., *State Commissioner of Health:*

A reinspection of the public water supply of Unionville was made on August 18, 1915, by Dr. C. W. Berry, sanitary supervisor of district "N." A previous investigation of this supply was made in 1908 by the Engineering Division, the report of which will be found on page 315, volume II, of the twenty-ninth annual report of this Department.

The public water supply of this village is derived from two driven wells located in the southern part of the village. A description of these wells and the water supply system in general remains practically the same as given in detail in the earlier report. In addition to the water derived from the wells a reservoir located in the northwestern part of the village impounds a small amount of water from springs and surface runoff.

The wells are driven through 7 feet of hardpan, 8 feet of blue clay and terminate in a water-bearing gravel. These wells are flowing wells and the water from them is collected in a masonry basin from which the supply is pumped into the distribution system. At the time of the reinspection this basin was covered with a heavy growth of algae. The water from this basin is pumped into the mains only when the supply obtainable from the springs at the reservoir is insufficient to supply the village. The water from the reservoir is subject to contamination by surface wash from the land which slopes on all sides toward it. There are no provisions for the proper protection of this reservoir from surface drainage and cattle are pastured on the adjacent land.

At the time of the previous report the following conclusions were made:

1. The public water supply of the village of Unionville is of very unsatisfactory sanitary quality. Whether the water in the wells from which the water supply is pumped is polluted, or whether this pollution has taken place subsequent to its flow from the wells, has not been determined.

2. The water from the wells is exposed to pollution even before being pumped into the mains. It flows from the wells into an earthen pool which is not protected from contamination by the overflow from the small stream referred to above.

3. The reservoir is open and is covered with a thick algae growth which, while not dangerous to health, gives the water an unpleasant taste and odor.

4. The reservoir is not protected from surface wash. On the slope immediately above it, cow droppings are in evidence, and the wash from these into the reservoir without doubt nurtures the algae growth existing there.

As a result of these conclusions the following recommendations were made:

1. Owing to the sample taken for analyses having been perhaps a composite one of surface and well water and on account of the several opportunities the public water supply has to become polluted subsequent to its discharge from the wells, it is necessary that the purity of the water from the wells from which the public water supply is obtained, should be ascertained and samples for chemical and bacteriological analysis should be taken at once direct from the wells.

2. If the results of this analysis show the water from this source to be safe and wholesome, these wells should be protected from surface wash, either from flooding of the neighboring stream or otherwise, by constructing a concrete or masonry pumping basin to receive their flow.

3. Since the amount of water obtained from the small stream at present flowing into the reservoir is uncertain and negligible, it may be abandoned and a covered concrete or masonry reservoir should be built to replace the old one. The present reservoir is in a filthy condition and

is subject to objectionable surface wash. It is essential, therefore, that immediate steps should be taken to build a new reservoir.

4. The new reservoir and pumping basins should each be covered to prevent the trouble from algae growths which will occur in ground water exposed to sunlight.

5. If the water in the wells is found by analysis to be of questionable purity, the matter is one of a serious nature, and steps should be taken at once either to remove the pollution affecting this supply or to secure a new supply.

From the report of Dr. Berry it appears that except for construction of the masonry collecting basin at the wells, none of the recommendations of this Department have been carried out by the water company although the conditions affecting the sanitary quality of the supply remain practically the same as described in the earlier report.

At the time of his inspection Dr. Berry collected samples of the water from the reservoir and from the well and the results of the analyses of these samples made by the Division of Laboratories and Research will be found in the appended table.

These analyses are too few in number to permit the drawing of definite conclusions as to the quality of the water at all times and under all conditions. The appreciable odor in the samples indicates that the water from both the springs and well are affected to some extent by the growths of algae. The figures for nitrogen in its various forms show the presence of considerable decomposing and decomposable organic matter. The figures for nitrates and chlorine in the reservoir water also indicate the occurrence of organic contamination, this contamination, however, being comparatively well oxidized by passage through the soil. The total bacterial counts are high although it should be noted that the samples were two days in reaching the laboratory. The occurrence of fecal organisms of the B. coli type indicates the occurrence of a certain amount of active contamination of animal or human origin.

In view of the above facts the following conclusions may be drawn:

1. That the Unionville Water Co. has apparently carried out none of the recommendations of this Department, except for providing a concrete collecting basin at the wells.

2. That the location of the wells in a comparatively thickly settled village renders it very probable that the water derived from them receives serious contamination due to the pollution of the ground water sources tributary to the wells by leaching cesspools and privies. That such contamination actually occurs is indicated strongly by the analytical results.

3. That the supply derived from the hill reservoir is open to contamination of animal origin due to surface wash from the pasture lands bordering this reservoir.

4. That both collecting reservoirs are subject to growths of algae which may bring about disagreeable tastes and odors in the supply.

I would, therefore, recommend:

1. That the water company take immediate steps to determine whether it is possible to prevent all contamination of the supply derived from the wells in the village.

2. That the hillside reservoir be protected from surface wash by adequate drainage ditches and fences or by the construction of a suitable masonry reservoir.

3. That in case it is found impossible or impracticable to properly protect the present supplies from contamination, the water company secure a new supply of unquestionable sanitary quality and adequate in quantity, pending which the present supply should be sterilized with liquid chlorine.

Respectfully submitted,

THEODORE HORTON,
Chief Engineer

ALBANY, N. Y., *November* 26, 1915

REPORT OF WATER ANALYSIS FOR UNIONVILLE

Source	Well	Reservoir	Tap
Collected on	8/18/15	8/18/15	8/18/15
Color	5	Trace	....
Odor, hot	4 a.	3 v.	....
Odor, cold	4 a.	3 v.	....
Turbidity	1	1	....
Solids, total	87	102	....
Loss on ignition	15	17	....
Mineral residue	72	85	....
Ammonia, free	.034	.018	....
Ammonia, albuminoid	.080	.084	....
Nitrites	Trace	.002	....
Nitrates	.060	2.40	....
Oxygen consumed	3.10	0.30	....
Chlorine	1.75	8.50	....
Hardness, total	31.2	60.0	....
Alkalinity	2.0	35.0	....
Bacteria per c. c.	800	1,200	3,900
B. coli type 10 c. c.	1+2—	1+2—	2+1—
B. coli type 1 c. c.	0+3—	0+3—	0+3—
B. coli type 1/10 c. c.	0+3—	0+3—	0+3—

Results are expressed in parts per million. Present. — Absent.
Abbreviations used to describe odors of water: 0, none; 1, very faint; 2, faint; 3, distinct; 4, decided; 5, strong; 6, very strong; a, aromatic; d, disagreeable; e, earthy; f, fishy; g, grassy; m, musty; v, vegetable.

WALDEN

HERMANN M. BIGGS, M.D., *State Commissioner of Health:*

A reinspection of the public water supply of this village was made on June 1, 1915, by Dr. C. W. Berry, sanitary supervisor, of district "N." A full report of a previous investigation of this water supply made by the Engineering Division in 1909 will be found on page 347, volume II, of the thirtieth annual report of this Department. In 1913, a serious outbreak of typhoid fever occurred in the village, the cause of which was attributed to the infection of the water supply. The report of an investigation of this epidemic will be found on page 761 of the thirty-fourth annual report of this Department.

The water supply of Walden is derived from two sets of driven wells, one located in the eastern part of the village itself and the other set, about one mile east of the village. The water works system remains practically the same as described in the previous reports. The water works are owned and operated by the village.

The wells at pumping station No. 1, which are those located within the village, are the same as described in the previous report, although an effort has been made to improve the surroundings of this station and many of the privy vaults in the vicinity have been removed, those remaining having water-tight pits of concrete construction. At pumping station No. 2 about one mile southeast of the village, there are nine wells, of which three are new, two of the old ones having been cut out and one redrilled to a depth of 160 feet. One of the new wells, 150 feet deep, is connected with a covered reservoir, built in 1913, of brick construction, 25 feet in diameter and 12 feet deep, lined inside and outside with cement, and with a capacity of about 40,000 gallons. An air compressor is about to be installed at the No. 2 pumping station in order to force the water from all the wells into the small reservoir, the plan being to abandon No. 1 station, if enough water can be obtained from these wells. In 1914, an apparatus for the sterilization of the water supply derived from No. 1 pumping station was installed, but never having worked properly, has been entirely removed and the water is now unsterilized.

At the time of the previous report in 1909, it was pointed out that, while

the water that came from the wells outside the village was of a good sanitary quality, the water obtained from the wells within the village was subject to contamination and that the water obtained from this source of supply was undoubtedly responsible for most of the typhoid fever which had occurred in the past. It was, therefore, recommended that the village authorities abandon the wells located at station No. 1 and obtain an additional supply from some new source of satisfactory quality and that, in order to determine the best method of obtaining an additional supply, it would be advisable for the village authorities to retain the services of an expert engineer. Little, if any, attention was paid to these recommendations by the village authorities, until in December 1913, there occurred a serious outbreak of typhoid fever in the village. An investigation made by the Engineering Division showed that the primary cause of this outbreak was the infection of the water supply due to the contamination of the water derived from the wells in No. 1 station at the time of overflow of a sewer a short distance from the wells.

Among the recommendations made as a result of this investigation were the following:

> "2. That, as previously recommended, the village authorities proceed to abandon at once the supply at pumping station No. 1 and secure a new and safe supply from some other source. Such a supply should not be adopted until after a thorough study and investigation by a competent expert.
>
> "4. That the village engage a sanitary expert to advise and carry out the methods for the general cleaning up of the village by providing safe water, adequate sewerage, proper garbage disposal, and such other sanitary reforms as may be found necessary."

Since the later report, it appears that the village had attempted to improve the quality of the water derived from the wells at pumping station No. 1 by means of sterilization with liquid chlorine, but that such attempt has not proved successful and has been abandoned. In respect to the recommendations regarding proper sewerage, it appears that plans for a sewer system and sewage disposal plant have been submitted to this Department for approval but as yet such improvements have not been fully constructed.

The dangerous condition existing at pumping station No. 1 with respect to possibility of contamination of the wells, and even actual infection as shown by the repeated typhoid outbreaks in the village, has been emphasized by this Department again and again. The continuance of the use of water from these wells located in the village is attended by the ever present probability of a reoccurrence of similar typhoid fever outbreaks and only by the complete abandonment of these wells will the village authorities fulfill their duties toward their fellow citizens.

At the time of the reinspection, samples of water were collected from both sets of wells and from a tap in the village and the analyses of these samples made by the Division of Laboratories and Research will be found in the appended table.

The analyses of this supply which have been made in the past and which may be found tabulated in the earlier reports show clearly the unreliable sanitary quality of the supply derived from the wells at pumping station No. 1. Although this supply is at times free from active contamination there are other times when fecal organisms of the B. coli type occur in samples as small as 1 c. c. Furthermore, the figures for chlorine and nitrates are at all times excessively high indicating the continued pollution of the ground water tributary to these wells. The location of wells in a thickly populated district is always attended by danger of serious contamination, especially when the rock strata are full of seams and channels which may conduct polluted surface water directly to the wells. Although the analyses may show that the water is often free from contamination they also show that freedom is not obtained under all conditions of draft upon the wells and under various hydraulic conditions of the ground water. Analyses of the water from the wells of the No. 2 pumping station show a supply of reasonably satisfactory

sanitary quality being in most cases free from evidences of past contamination and low in total numbers of bacteria and practically free from organisms of the B. coli type.

In view of the above facts the following conclusions may be drawn:

1. That the village authorities have as yet failed to carry out in full the recommendations of the previous reports, especially in regard to the abandonment of pumping station No. 1.

2. That as long as the supply from the No. 1 wells is used, the village will be menaced by the possibility of outbreaks of typhoid fever.

3. That the water supply derived from the No. 2 station if properly protected from contamination, will afford a supply of satisfactory sanitary quality.

I would, therefore, recommend:

1. That the village authorities abandon at once the wells located at pumping station No. 1.

2. That in case the supply obtainable from the wells at station No. 2 is insufficient in quantity, the village authorities consider the development of a new supply of a satisfactory sanitary quality.

Respectfully submitted,

THEODORE HORTON,
Chief Engineer

ALBANY, N. Y., *August* 5, 1915

Results of Water Analyses

Abbreviations used to describe odors of water: 0, none; 1, very faint; 2, faint; 3, distinct; 4, decided; 5, strong; 6, very strong; a, aromatic, d, disagreeable; e, earthy; f, fishy; g, grassy; m, musty; v, vegetable

Municipality	County	Source of sample	Date of collection	Physical				Chemical (Parts per Million)											Bacteriological			
						Odor		Solids			Nitrogen as—						Hardness			B. Coli Type (+ = present, — = absent)		
				Color	Turbidity	Cold	Hot	Total	Loss on ignition	Mineral residue	Free ammonia	Albuminoid ammonia	Nitrites	Nitrates	Oxygen consumed	Chlorine	Total	Alkalinity	Bacteria per c.c.; gelatin 20°, 48 hours	10 c.c.	1 c.c.	1-10 c.c.
Walden	Orange	Tap, public supply	3/26/14	Tr.	Tr.	1 v.	1 v.	170	19	151	.040	.042	.001	0.24	0.50	2.00	125.8	119.0	325	0+3—	0+3—	0+3—
Walden	Orange	Pump station No. 1	6/ 1/15	Tr.	Cl.	1 v.	1 v.	222	6	216	.002	.002	.001	1.60	0.50	7.25	160.0	147.0	15	0+3—	0+3—	0+3—
Walden	Orange	Pump station No. 2	6/ 1/15	Tr.	Cl.	1 v.	1 v.	193	7	186	.008	.006	.001	0.80	0.70	2.25	154.2	120.0	10	1+2—	0+3—	0+3—
Walden	Orange	Tap, public supply	6/ 1/15	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	30	0+3—	0+3—	0+3—
Walden	Orange	Reservoir station No. 2	6/ 1/15	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	950	0+3—	0+3—	0+3—

WASHINGTONVILLE

HERMANN M. BIGGS, M.D., *State Commissioner of Health:*

A reinspection of the public water supply of Washingtonville was made on August 24, 1915, by Dr. C. W. Berry, sanitary supervisor of district "N." The previous inspection of this supply was made in 1909 by the Engineering Division, a report of which will be found on page 352, volume II, of the thirtieth annual report of this Department.

The public water supply of this village is derived from the Otterkill creek at a point 1¾ miles southeast of that village. At this point there is an open reservoir formed by the masonry dam. This reservoir has an area of about one-quarter of an acre and a capacity of about 1,000,000 gallons. Formerly the water before entering the mains passed through a so-called filter of charcoal. This was constructed by making a stone chamber into which a few loads of charcoal were dumped through which the water passed to the intake pipe. This so-called filter has never been refilled or cleaned and most of the original charcoal has disappeared. The chamber has been filled with coarse stone and the water is screened through a perforated copper plate with ¼-inch holes.

The stream from which the water supply is taken rises in a deep valley in the Schunemunk mountains and follows a meandering course for about a mile before it enters the reservoir. The watershed is about 3 square miles in area, about one-half of which is wooded and the remainder devoted to agriculture. The slopes are steep and the underlying rock strata are sandstone.

There are about 10 houses on the watershed with a population of about 50, or 16 per square mile. All but four of these houses are located a safe distance from the stream. A few hundred feet above the reservoir the slope of the land is very steep and surface wash runs into the reservoir from a barn and manure pile. The next farm, in addition to the usual farm buildings, has a privy on the steep edge of a small stream which is tributary to the main stream. The third farm has a privy and manure pile, all of which are on the side of a steep bank from which the surface wash enters the stream. At the fourth farm there is a hogpen and a large chicken yard directly on the stream.

Considerable trouble has been experienced with algae growths in the reservoir during the summer and many people in the village do not use the water for drinking purposes.

At the time of the previous inspection the above sources of pollution were noted and the unsatisfactory esthetic quality of the supply due to algae growths was clearly pointed out. It was therefore recommended:

1. That the village authorities make a thorough inspection of the watershed in order to remove all existing sources of contamination and to guard against their recurrence in the future.

2. That in case they experience any difficulty in removing sources of pollution of the water supply, the authorities should consider the question of application to this Department for the enactment of rules and regulations for the protection of their water supply.

3. That in case the taste and odor should become objectionable their removal may be accomplished by:

   (a) Removing the pollution of the watershed and cleaning the sides and bottom of the reservoir.

   (b) Controlling algae growths in the reservoir by the cautious application of copper sulphate.

   (c) Removing tastes and odors by aeration alone or by aeration and filtration.

From the report of Dr. Berry it would appear that none of these recommendations have been carried out by the village authorities and that the

insanitary conditions prevailing upon the watershed remain a serious menace to the quality of the supply.

At the time of his inspection Dr. Berry collected samples of water and the results of the analyses of these samples together with others made in the past by the Division of Laboratories and Research will be found in the appended table.

These analyses show a water supply somewhat high in color, occasionally very turbid and moderately soft. The figures for nitrogen in its various forms and for carbonaceous matter show a rather more than moderate amount of decomposing and decomposable organic matter. The chlorine content is also above normal found in uncontaminated surface waters in this region. The bacterial counts in most samples are very high and the almost constant occurrence of fecal organisms of the B. coli type indicates considerable contamination from animal or human sources.

In view of the above the following conclusions may be drawn:

1. That apparently none of the recommendations of this Department have been carried out by the local authorities.

2. That the need for the recommended improvements still exists, due to the fact that the water supply is open to serious contamination by surface wash from pastures, manured fields, highways, barnyards and privies.

3. That the unsatisfactory quality of the water supply causes many people in the village to secure drinking water from private wells which are probably in many cases seriously contaminated.

I would therefore recommend:

1. That the village authorities give their immediate attention to the question of securing an adequate and wholesome water supply, either along the lines suggested in the recommendations of the previous report or by developing a new supply from a source of unquestionable sanitary quality.

Respectfully submitted,

THEODORE HORTON,
Chief Engineer

ALBANY, N. Y., *November* 15, 1915

RESULTS OF WATER ANALYSES

Abbreviations used to describe odors of water: 0, none; 1, very faint; 2, faint; 3, distinct; 4, decided; 5, strong; 6, very strong; a aromatic; d, disagreeable; e, earthy; f, fishy; g, grassy; m, musty; v, vegetable

Municipality	County	Source of sample	Date of collection	Physical				Chemical (Parts Per Million)											Bacteriological			
						Odor		Solids			Nitrogen as—						Hardness		Bacteria per c.c.; gelatin 20°, 48 hours	B. Coli Type + = present — = absent		
				Color	Turbidity	Cold	Hot	Total	Loss on ignition	Mineral residue	Free ammonia	Albuminoid ammonia	Nitrites	Nitrates	Oxygen consumed	Chlorine	Total	Alkalinity		10 c.c.	1 c.c.	1-10 c.c.
Washingtonville	Orange	Tap, public supply	3/29/11	25	50	....	....	77	34	43	.008	.112	.002	0.10	6.20	3.25	27.3	16.0	2,700	+	+	+
Washingtonville	Orange	Tap, public supply	12/13/11	10	Tr.	....	....	81	10	71	.010	.060	.001	0.16	0.82	1.87	29.3	27.0	600	+	—	—
Washingtonville	Orange	Tap, public supply	2/29/12	10	10	....	....	83	18	25	.056	.100	.001	0.24	3.50	1.50	20.8	17.0	18,000	+	+	—
Washingtonville	Orange	Tap, public supply	4/ 5/12	15	Tr.	....	....	42	10	32	.006	.080	.001	0.16	2.20	1.50	19.5	14.0	5,000	+	+	—
Washingtonville	Orange	Tap, public supply	8/19/12	23	8	....	....	83	18	65	.002	.096	Tr.	0.14	3.40	2.62	62.9	58.0	550	+	+	—
Washingtonville	Orange	Tap, public supply	10/ 5/12	10	15	....	....	86	12	74	.012	.120	Tr.	0.10	2.80	2.00	48.6	48.0	33,000	+	+	—
Washingtonville	Orange	Tap, public supply	11/11/12	3	Tr.	....	....	70	10	60	.010	.072	.001	0.08	1.90	1.75	27.3	23.0	....	+	+	—
Washingtonville	Orange	Tap, public supply	1/30/13	5	5	....	....	50	....	....	.006	.046	.001	0.16	1.40	1.75	27.3	18.0	60	—	—	—
Washingtonville	Orange	Tap, public supply	5/29/13	13	2	....	....	46	....	....	.004	.056	Tr.	0.08	1.80	1.50	22.1	18.0	550	+	—	—
Washingtonville	Orange	Tap, public supply	8/24/15	10	5	....	....	73	8	65	.008	.088	.002	0.10	3.56	1.75	32.5	28.0	1,300	3+0—	3+0—	3+0—

WASSAIC

HERMANN M. BIGGS, M.D., *State Commissioner of Health:*

An investigation of the public water supply of Wassaic was made on August 7, 1915, by Mr. M. F. Sanborn, assistant engineer, who was assisted at the time of the inspection by Dr. F. L. Filkins, health officer of the town of Amenia; Mr. George Birch, president and treasurer of the company, and Mr. John R. Thompson of Amenia, secretary and superintendent.

Wassaic is an unincorporated village located in the town of Amenia in the eastern part of Dutchess county. It is about 22 miles east of the city of Kingston and lies in the valley of Ten Mile river. The Harlem division of the New York Central railroad passes through the village. The population at the time of the inspection was estimated at about 125.

The public water supply is furnished by the Wassaic Water Company and is used principally for household purposes. No fire protection is provided in the village. The water works were designed and constructed by Mr. J. R. Thompson in 1893.

The water is obtained chiefly from a spring which is located on the side of the mountain about three-quarters of a mile north of the center of the village and an emergency supply is derived at times from a shallow dug well near Ten Mile river in the center of the village. From the spring the water is fed directly to the distributing mains and reservoir. The water from the well, which is used only during times of drought, has to be pumped to the mains.

About 56 people or 45 per cent. of the total population are served by this supply. The daily consumption is unknown and there was no method by which this could readily be obtained. There is about one mile of water main varying from 1 to 3 inches in diameter. There are about 40 houses in the village, of which 18 are served by the supply. The average pressure is about 40 pounds per square inch.

There is no system of sewerage or sewage disposal in the village except local cesspools, septic tanks and privies.

The spring from which the greater part of the water is obtained is located on the side of a mountain. There are two basins at this spring about 3 feet square and 15 feet apart. These basins are of stone masonry on the sides and have wooden covers. The water of the springs apparently flows under ground for 300 or 400 feet immediately above the springs, while above this point the water flows on the surface of the ground. There are about three acres of land through which the water flows after issuing from the rocks of the mountain above. This area has been fenced to prevent pollution of the water by cattle pasturing on the mountain side, although at one place the flowing water was at the fence line. The source of supply of the spring is probably in a shale or schist formation, although the water passes over and through considerable limestone before it reaches the springs. The rocks also show indication of iron.

The auxiliary well is about 25 feet from Ten Mile river. It is a dug well and is excavated through coarse sand and gravel to a depth of four feet. From the bottom of the well a 2-foot length of 10-inch iron tile was sunk. At the time of the sinking of the well the water could not be pumped out as fast as it entered and it was consequently found impracticable to extend its depth to more than six feet. At no time has this well been pumped dry and this is undoubtedly due to the rapid infiltration of creek water into the well through the coarse sand and gravel.

The pumping station located adjacent to the well is a wooden building about 10 by 12 feet in plan. The pumping plan consists of a Douglas triplex plunger pump having 4-inch cylinders and 6-inch stroke. It is rated at about 35 gallons per minute. The pump is operated by a 4-H. P. Ford Jr. gasoline engine.

The reservoir is located on the side of the mountain about one-half way between the village and the springs. It is constructed of concrete and is

16 by 24 feet in plan and 10 feet deep, with a capacity of 28,000 gallons. The reservoir is covered with a wooden roof which originally had tar paper over the same, but the paper has been removed, leaving openings in the roof from one-quarter to 1 inch between the boards. The reservoir is said to be cleaned out and the water mains flushed about once a year.

The area of the watershed above the springs is comparatively small, although the area at the elevation of the springs from which they might draw water is approximately one-half square mile. There are no houses above the springs and the only pollution is that from the cattle pasturing above them. The springs during certain seasons of the year are practically dry and at such times the water from the well is used. Due to the continued rains this summer the well water had not been used this year.

The watershed tributary to the well is unknown, although the watershed of Wassaic creek, which flows about 500 feet from the well, is about 25 square miles, and that of Ten Mile river is about 11½ square miles. These two creeks which flow by or near the well are probably polluted to some extent. The Wassaic creek flows through the village of Amenia and Ten Mile creek flows through a sparsely settled district. Both of these creeks flow through considerable limestone as well as shale and schist, although the Wassaic watershed probably has less limestone than that of the Ten Mile river.

There are about nine houses from 300 to 400 feet from the well, about fifteen houses within 500 feet and seven houses from 500 to 1,000 feet from the well. About 20 feet southwest of the well is a barnyard in which was stored a large pile of manure, about 50 feet north of the well is a pigpen which contained two or three pigs, and about 125 feet west of the well is a privy and there are also privies and cesspools for practically all of the houses in the village. This condition gives opportunity for considerable local pollution of the well water as well as that received by the infiltration of polluted river water.

At the time of the inspection samples of the spring water, the well water and the river water were taken and the analyses of the same will be found in the following table:

REPORT OF WATER ANALYSIS FOR WASSAIC

Collected from		Tap at store	Well	
Collected on		8/7/15	8/7/15	....
Color		3	Trace	....
Odor, hot		1 v.	1 a.	....
Odor, cold		1 v.	1 a.	....
Turbidity		Clear	2	....
Solids, total		123	206	....
Loss on ignition		10	22	....
Mineral residue		113	184	....
Ammonia, free		.002	3.002	....
Ammonia, albuminoid, total		.010	.010	....
Nitrites		.001	.002	....
Nitrates		0.20	1.60	....
Oxygen consumed		1.20	0.40	....
Chlorine		2.25	4.25	....
Hardness, total		67.00	177.20	....
Alkalinity		62.00	158.00	....
Iron		0.30	0.10	....
Bacteria per c.c.		190	300	2,300
B. coli group	10 c. c. inoculations	3+0—	3+0—	3+0—
	1 c. c. inoculations	0+3—	1+2—	3+0—
	1/10 c. c. inoculations	0+3—	1+2—	3+0—

These analyses show that the spring water is slightly colored, practically free from turbidity and moderately hard. Nitrogen in its different forms is comparatively low, although the oxygen consumed and chlorine are somewhat high for this region. The bacterial results indicate a slight amount

of pollution as shown by the presence of fecal organisms of the B. coli type, although the total bacterial count is not excessive. Such contamination is, however, derived in all probability from the cattle pastured above the springs.

The well water is practically colorless, slightly turbid and very hard. The nitrogen in its different forms shows some pollution, which, however, had apparently been well nitrified. The chlorine is also fairly high and indicates pollution. The bacterial count is high and fecal bacteria of the B. coli group were found in samples as small as 1/10 c. c., indicating active contamination of animal or human origin.

The bacterial examination of the river water shows the presence of B. coli in 1/10 c. c. samples thus showing the occurrence of serious contamination.

As a result of this investigation and of the analyses the following conclusions may be drawn:

1. That the springs forming the principal source of public water supply of Wassaic are polluted to a small extent by cattle in the pasture above the springs.
2. That the water from the auxiliary well supply is unsafe for use as a public water supply without adequate filtration or sterilization.
3. That the river water, the rapid infiltration of which supplies the auxiliary well, is badly polluted as shown by the bacteriological analyses.
4. That the sanitary conditions near the well are very bad, due to the close proximity of the manure pile, pigpen and privies.
5. That the coarse sand and gravel strata in which the well is located give little or no purification to the waters filtering into this well.

In view of the above conclusions I would recommend that the water company take the following steps to safeguard the water from pollution:

1. Protect the springs and the stream above the springs from contamination by cattle by extending the fence at the brook and springs.
2. Abandon the use of the well as a source of water supply unless adequate filtration or sterilization is provided, in addition to which the insanitary condition of the area immediately surrounding the well should be removed.
3. Develop additional springs if possible in order that an adequate supply may be obtained in order to make unnecessary the use of the well water.

Respectfully submitted,
THEODORE HORTON,
Chief Engineer

ALBANY, N. Y., *October* 11, 1915

WATERLOO

HERMANN M. BIGGS, M.D., *State Commissioner of Health:*

A reinspection of the public water supply of Waterloo was made on January 11, 1915, by Dr. H. H. Crum, sanitary supervisor of district "R," and the following report is based largely upon information furnished by him. An earlier report of a full investigation of this water supply by the Engineering Division will be found on page 356, volume II, of the thirtieth annual report of this Department:

The water supply of this village is pumped from the Seneca river about one mile west of the center of the village. At the time of the previous investigation the water was subjected to no form of purification whatever. Since the summer of 1914, however, the water has been filtered through two pressure mechanical filters using sulphate of alumina as a coagulant. The intake, pumping station and distribution system remain practically the same as at the time of the earlier report. One of the pumps is now electrically operated, and it is planned to discard the steam boilers in the near future and use electric power exclusively. A new water distribution tank has also been

constructed. This tank is of steel supported by a steel tower at an elevation of 155 feet above the ground and has a capacity of 204,200 gallons. The daily water consumption is roughly estimated at 750,000 gallons. The water works are owned and operated by the Waterloo Works Company.

The filters, which were installed by the Roberts Filter Mfg. Co. of Philadelphia, Pa., are of the horizontal, steel cylinder type, each with a daily capacity of 500,000 gallons. They are washed daily by reverse flow or filtered water from the standpipe, and after each washing the filtered water is wasted for ten minutes.

An old sedimentation basin, approximately 40 by 80 feet in plan and 10 feet deep, is used as a coagulation basin. The alum is mixed in two solution tanks; the solution then flows by gravity to a constant head orifice box, from which it is applied to the raw water entering the basin. This basin has not been cleaned for a number of years, and its capacity is probably greatly decreased by accumulation of silt. There are no baffle walls, and consequently there is little likelihood of efficient mixing and satisfactory coagulation. The amount of alum used is not known exactly. It is stated, however, that never more than 40 pounds is used per day, and with a rate of treatment of 750,000 gallons the amount of alum per gallon would be but 0.37 grain.

At the time of the installation of the filters a hypochlorite sterilization apparatus was also installed. This apparatus, however, has not been used.

The superintendent of the water works is not familiar with the chemical and bacteriological principles upon which are based the proper operation of a water purification plant. Therefore he plans to take at once a course in Hobart College for the purpose of acquiring such knowledge of chemistry and bacteriology as is necessary to assist him in supervising the operation of the purification works.

A short time previous to this inspection a strong taste of tar had been noticeable in the water. This taste was ascribed to the accidental discharge of wastes from a gas plant up the river.

At the time of the previous report the serious contamination of the water supply by the sewage of the city of Geneva and by other sources of contamination was clearly pointed out, and it was strongly recommended that the Seneca river either be abandoned as a source of supply or else be purified. It was also recommended that the water company employ a competent expert to carefully study the problem and advise them definitely as to the best means of providing a safe and wholesome water.

It appears then that the water company has lately acted along the lines recommended by this Department in the matter of installing a purification system, although it does not appear that any particular study was made of the problem of securing the best type of purification system or best methods of operation.

At the time of his inspection Dr. Crum collected samples of filtered and unfiltered water, and the results of the analyses of these samples, together with others made in the past by the Division of Laboratories and Research, will be found in the appended table.

The high bacterial counts and the constant occurrence of B. coli in small inoculations of the samples show clearly the serious contamination of the raw water supply. The analyses of the single series of samples taken to determine the efficiency of the filters indicate that at the time of the collection of these samples the filters were effecting absolutely no improvement in the sanitary quality of the supply, but on the contrary were apparently increasing the total numbers of bacteria.

In view of the above facts the following conclusions may be drawn:

1. That the Waterloo Water Works Company, by the installation of a water purification plant, has acted along the lines of the previous recommendations of this Department.

2. That as operated at present this purification system is not giving satisfactory bacterial efficiency.

3. That the silting up of the preliminary settling basin and the absence of baffles probably prevent this basin from bringing about adequate coagulation and sedimentation.

4. That the amount of alum used is applied rather haphazardly and probably in insufficient quantity for proper coagulation.

5. That coagulation, sedimentation and treatment with pressure mechanical filters is manifestly insufficient to completely improve the sanitary quality of a water supply derived from a source so seriously contaminated.

6. That the results obtained from this method of purification will depend practically wholly upon the care and intelligence with which the plant is operated.

I would, therefore, recommend:

1. That the preliminary sedimentation basin be cleaned and provided with proper baffle walls in order to increase its efficiency.

2. That the amount of alum used be increased to such an amount as will give good coagulation.

3. That the hypochlorite sterilization apparatus be put into service and operated continuously. The amount of hypochlorite necessary to add must be determined by trial under analytical control.

4. That daily chemical and bacterial analyses be made in order that careful control may be maintained of the purification process.

Respectfully submitted,

THEODORE HORTON,
Chief Engineer

ALBANY, N. Y., *February* 15, 1915

REPORT OF WATER ANALYSIS FOR WATERLOO

Source	Tap, public supply	Tap, public supply	Tap, public supply	Tap, public supply	Tap, public supply
Collected on	2 12 12	3 30 12	10 9 12	11 26 12	12 30 12
Color	Trace	25	10	5	5
Turbidity	Clear	12	20	Trace	20
Solids, total	251	167	278	247	258
Loss on ignition	30	31	88	27	30
Mineral residue	221	136	188	220	228
Ammonia, free	.040	.038	.010	.044	0.30
Ammonia, albuminoid	.084	.218	.180	.096	0.082
Nitrites	Trace	.002	.003	004	002
Nitrates	0 40	0.36	0.26	0.36	0.36
Oxygen consumed	1.20	6.40	1 30	1 90	3.50
Chlorine	60.0	29.0	60.0	61.0	61.0
Hardness, total	114.2	77.1	180.6	111.4	114.2
Alkalinity	112.0	68.0	102.0	105.0	103.0
Bacteria per c. c.	....	5,300	2,000	1,900	4,100
B. coli type, 10 c. c.	....	+	+	+	+
B. coli type, 1 c. c.	....	+	+	+	—
B. coli type, 1/10 c. c.	....	+	+	+	—

Results are expressed in parts per million. + Present. — Absent.

Abbreviations used to describe odors of water: 0, none; 1, very faint; 2, faint; 3, distinct; 4, decided; 5, strong; 6, very strong; a, aromatic; d, disagreeable; e, earthy; f, fishy; g, grassy; m, musty, v, vegetable.

REPORT OF WATER ANALYSIS FOR WATERLOO

Source	Tap, public supply	Tap, public supply	Tap, public supply	Tap, public supply
Collected on	2/7/13	5/15/13	6/19/13	7/24/13
Color	10	5	10	5
Odor, hot	1 v.	1 v.	2 a.	1 v.
Odor, cold	1 v.	1 v.	2 a.	1 v.
Turbidity	20	Trace	15	5
Solids, total	261	242	258	271
Ammonia, free	.014	.010	.006	.004
Ammonia, albuminoid	.088	.068	.134	.186
Nitrites	.001	.001	.002	.002
Nitrates	0.34	.030	0.16	0.24
Oxygen consumed	2.50	1.90	1 80	1.20
Chlorine	61.0	59 0	61.0	58.0
Hardness, total	108.6	108 60	102.8	100.0
Alkalinity	101.0	96.0	95.0	95.0
Bacteria per c. c	7,600	6,100	200,000	300
B. coli type, 10 c. c.	3+0—	3+0—	3+0—	3+0—
B. coli type, 1 c. c.	2+1—	0+3—	2+1—	2+1—
B. coli type, 1/10 c. c.	1+2—	0+3—	1+2—	1+2—

Results are expressed in parts per million. + Present. — Absent.

Abbreviations used to describe odors of water: 0, none; 1, very faint; 2, faint; 3, distinct; 4, decided; 5, strong; 6, very strong; a, aromatic; d, disagreeable; e, earthy; f, fishy, g, grassy; m, musty; v, vegetable.

REPORT OF WATER ANALYSIS FOR WATERLOO

Source		Tap, public supply	Tap, public supply	Tap, public supply	Tap, public supply
Collected on		5/1/14	10/5/14	10/5/14	10/5/14
Color		Trace	Trace	....	....
Odor, hot		2 a.	1 v.	....	....
Odor, cold		2 a.	1 v.	....	....
Turbidity		40	1	....	....
Solids, total		304	273	....	....
Loss on ignition		45	35	....	....
Mineral residue		259	238	....	....
Ammonia, free		.042	.006	....	....
Ammonia, albuminoid		.080	.032	....	....
Nitrites		.001	.001	....	....
Nitrates		0.36	0.16	....	....
Oxygen consumed		2.40	2.20	....	....
Chlorine		56.0	62.5	....	....
Hardness, total		117.2	114.2	....	....
Alkalinity		102.0	99.0	....	....
Bacteria per c. c.		300	Liq.	Liq.	Liq.
B. coli type	10 c. c.	2+1—	3+0—	3+0—	3+0—
	1 c. c.	0+3—	1+2—	0+3—	1+2—
	1/10 c. c.	0+3—	0+3—	0+3—	0+3—

Results are expressed in parts per million. + Present. — Absent.
Abbreviations used to describe odors of water: 0, none; 1, very faint; 2, faint; 3, distinct; 4, decided; 5, strong; 6, very strong; a, aromatic; d, disagreeable; e, earthy; f, fishy; g, grassy; m, musty; v, vegetable.

REPORT OF WATER ANALYSIS FOR WATERLOO

Source		Raw water at pump	Raw water at pump	Filtered water at filter	Filtered water
Collected on		1/12/15	1/12/15	1/12/15	1/12/15
Bacteria per c. c.		11,000	7,000	47,500	45,500
B. coli type	10 c. c.	3+0—	3+0—	3+0—	3+0—
	1 c. c.	3+0—	3+0—	3+0—	3+0—
	1/10 c. c.	0+3—	0+3—	0+3—	0+3—

Results are expressed in parts per million. + Present. — Absent.
Abbreviations used to describe odors of water: 0, none; 1, very faint; 2, faint; 3, distinct, 4, decided; 5, strong; 6, very strong; a, aromatic; d, disagreeable; e, earthy; f, fishy; g, grassy; m, musty; v, vegetable.

WATERTOWN

HERMANN M. BIGGS, M.D., *State Commissioner of Health:*

A brief inspection of the water filtration plant at Watertown was made by Mr. E. S. Chase, assistant engineer, on January 4, 1915, following a complaint received by the Department relative to an alleged failure to operate the plant sometime during the month of December, 1914.

The assistant engineer conferred with Dr. E. S. Willard, health officer of the city, and with Mr. F. H. Jennings, chemist and superintendent of the filtration plant. It appears that during the early or middle part of December several complaints were made to both Dr. Willard and Mr. Jennings relative to sediment in the water derived from taps in the city. It is said that about the time these complaints were received there had been tests made upon the distribution system and fire hydrants by the fire underwriters' association. The hydrants were opened wide in various sections of the city and closed before complete flushing of the mains had been brought about. Apparently this flushing stirred up sediment in the mains which appeared in water derived from taps.

The water supply of Watertown is derived from Black river, which is badly polluted by sewage and sulphite wastes from pulp and paper mills. The water supply is treated by coagulation with alum, preliminary sedimentation, rapid sand filtration and final sterilization with hypochlorite of lime. The character of the river water varies markedly, which renders it extremely difficult to treat, and constant analyses are necessary in order to properly proportion the amounts of chemicals used. This variation in the quality of the raw water is partly due to the intermittent discharge of the sulphite wastes from the paper mills located on the river above the filter plant and partly to changes in the amount of surface runoff. At times, especially when a large proportion of the runoff is due to melting snow, it becomes necessary to add hardness to the raw water in the form of soda ash in order that sufficient alkalinity may be present for a complete reaction with the alum.

A full description of the filter plant will be found on page 450, volume 2, of the thirtieth annual report of this Department. The purification system and the plant remain practically the same as described in the report referred to above. The alum is now applied to the raw water by means of a dry feed apparatus instead of from a solution tank and the sterilization with hypochlorite has been permanently adopted since the previous report. The hypochlorite is added to the filtered water before passing through the clear water basin, this hypochlorite being applied in solution and regulated by means of a constant head orifice box.

The amount of alum which it is found necessary to add varies from one and one-third to three grains per gallon and the soda ash, when necessary, is added in sufficient quantities to afford as complete reaction as possible. Hypochlorite is added in such amounts as to give from 0.2 to 1.0 parts per million of available chlorine.

Daily analyses are made by Mr. Jennings and his reports show a reduction in the bacterial count from one or more thousands per cubic centimeter in the raw water to less than 100 per cubic centimeter, as a rule in the treated water. B. coli are always found in one cubic centimeter of the raw water and often in 1/10 cubic centimeter while they are practically always absent in one cubic centimeter and usually in 10 cubic centimeters of the treated water. Samples were collected by Mr. Chase and analyzed by the Division of Laboratories and Research and the results may be found in the appended table as well as other results obtained in the past two years.

These analyses indicate that fairly efficient bacterial purification is accomplished, low counts being obtained except when the samples were delayed in transit, and B. coli practically always absent even in quantities as large as 10 cubic centimeters.

In respect to the possibility of raw water being pumped directly to the city it was stated by Mr. Jennings that it is absolutely impossible to pump untreated water into the mains except by the removal of the filter sand or by laying of a line of pipe. No bypass exists. It is his opinion that at times complete coagulation does not take place before filtration and that consequently, subsequent coagulation occurs in the water mains or distributing reservoir causing a sediment which may become stirred up by an unusual draft upon the system. It is also possible that the flushing of the water mains, although carried out more or less regularly is not done sufficiently thoroughly to remove all the sediment accumulated in the mains. In the past some trouble has also been experienced from "red water plague" due to corrosion of the water mains.

At present the rate of filtration is about 120 million gallons per acre per day and although this rate is not excessive for rapid sand filters, treating ordinary types of water, in this case, owing to the character of the water, the filters are worked right up to capacity, consequently plans have been prepared by Hazen and Whipple, consulting engineers, providing an addition to the present plant which will just double its capacity. Changes are also expected to be made in the baffle system in the coagulation basin. It is planned for these improvements to be made during the coming summer. Recently changes have been made in the method of washing one or two of the filters. By omitting the use of air and increasing the rate of water

wash, it has been found that less mixing of the filter sand with the underdrain gravel occurs. It is planned to change all the filters so as to use water wash only.

At the time of the recent inspection there were but three reported cases of typhoid in the city of Watertown and of these two were known to have been imported. Dr. Willard also stated that he knew of no undue prevalence of enteritis or other similar trouble. At one house at which a sample of water was collected, information was obtained relative to six cases of enteritis which occurred that latter part of November and for which the city water supply was the attributed cause. These cases, however, also used water from a well located in a thickly settled neighborhood. Other cases were not known of nor does it appear that any general occurrence of enteritis occurred throughout the city.

In conclusion it may be stated that in view of the information obtained it appears probable that the complaints respecting this water supply were due to the occurrence of turbidity in the water caused by the stirring up of sediment in the water mains and that there seems no reason to believe that raw water has been delivered to the city. It is true, however, that the water is difficult to treat and that filtration must be supplemented by hypochlorite treatment in order to secure proper bacterial purification.

Respectfully submitted,

THEODORE HORTON,
Chief Engineer

ALBANY, N. Y., *January* 23, 1915

RESULTS OF WATER ANALYSES

Abbreviations used to describe odors of water: 0, none; 1, very faint; 2, faint; 3, distinct; 4, decided; 5, strong; 6, very strong; a, aromatic; d, disagreeable; e, earthy; f, fishy; g, grassy; m, musty; v, vegetable

Municipality	County	Source of sample	Date of collection	Physical				Chemical (Parts Per Million)											Bacteriological			
						Odor		Solids			Nitrogen as—						Hardness			B. Coli Type + = present — = absent		
				Color	Turbidity	Cold	Hot	Total	Loss on ignition	Mineral residue	Free ammonia	Albuminoid ammonia	Nitrites	Nitrates	Oxygen consumed	Chlorine	Total	Alkalinity	Bacteria per c.c.: gelatin 20°, 48 hours	10 c.c.	1 c.c.	1-10 c.c.
Watertown	Jefferson	Tap, public supply	1/10/13	10	Cl.	1 v.	2 v.	67	....	....	.030	.044	.001	0.24	3.50	1.37	39.0	20.0	30	1+2—	0+3—	0+3—
Watertown	Jefferson	Tap, public supply	2/17/13	10	3	1 v.	1 v.	86	....	....	.026	.074	.001	0.24	7.00	0.75	39.0	19.0	10	0+3—	0+3—	0+3—
Watertown	Jefferson	Tap, public supply	3/29/13	15	5	1 v.	1 v.	72	....	....	.028	.086	Tr.	0.14	4.00	1.25	28.6	21.0	*550	0+3—	0+3—	0+3—
Watertown	Jefferson	Tap, public supply	5/10/13	Tr.	Cl.	2 v.	2 v.	85	....	....	.012	.044	.001	0.08	5.40	1.25	47.1	25.0	20	0+3—	0+3—	0+3—
Watertown	Jefferson	Tap, public supply	6/21/13	10	Tr.	2 v.	2 v.	81	....	....	.012	.042	.001	0.04	4.80	0.87	36.4	13.0	....	0+3—	0+3—	0+3—
Watertown	Jefferson	Tap, public supply	7/26/13	Tr.	Tr.	2 v.	2 v.	108	....	....	.034	.080	Tr.	0.02	9.00	2.25	45.7	15.0	*100	0+3—	0+3—	0+3—
Watertown	Jefferson	Tap, public supply	5/16/14	Tr.	Cl.	1 v.	1 v.	66	16	50	.008	.052	Tr.	0.10	3.70	0.75	36.4	14.0	*350	0+3—	0+3—	0+3—
Watertown	Jefferson	Raw water at filter plant	1/ 4/15	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	750	3+0—	3+0—	0+3—
Watertown	Jefferson	Treated water at filter plant	1/ 4/15	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	10	0+3—	0+3—	0+3—
Watertown	Jefferson	Tap, city square	1/ 4/15	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	20	0+3—	0+3—	0+3—
Watertown	Jefferson	Tap, 136F Main St	1/ 4/15	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	10	0+3—	0+3—	0+3—

* More than 24 hours in transit.

WATKINS

HERMANN M. BIGGS, M.D., *State Commissioner of Health*:

A reinspection of the public water supply of Watkins was made on January 25, 1915, by Dr. H. H. Crum, sanitary supervisor of district "R" and the following report concerning the present condition of the supply is based largely upon information furnished by him. A previous investigation of this water supply was made in 1913 by Professor H. N. Ogden and the report of his investigation will be found in the thirty-fourth annual report of this Department.

The water supply of Watkins is derived by pumping directly from Seneca lake into high and low service distribution systems connected with equalizing reservoirs. A small amount of water collected from springs on the hillside is brought into the upper reservoir. The population of Watkins is about 3,000 and the daily water consumption is approximately 100,000 gallons. The water works are owned and operated by the village.

The intake from the lake is about ½ mile north of the village on the west shore and extends into the lake about 200 feet. The details of the intake, pumping station distribution system and water works in general remain practically the same as at the time of the previous investigation.

The watershed of the inlet of Seneca lake, Catherine creek, is about 150 square miles in area and, although on the whole comparatively sparsely populated, there are three villages located on this area, namely: Odessa, Montour Falls and Watkins. While more or less contamination is brought into the lake by the inlet from the wash from this watershed the chief source of contamination is the village of Watkins itself. The sewage from the village enters the lake at the south shore and at a point only 2,000 feet from the water works intake. Under ordinary conditions the effect of dispersion and sedimentation is probably such as to prevent contamination reaching the intake. It is probable, however, and in fact almost sure that, under certain conditions, wind currents are set up in the lake which carry sewage contamination in a comparatively short time to the water works intake. That such currents do carry contamination and at times infection in other lakes is shown by the experience of numerous cities in this country for instance, of Cleveland, Ohio, of Erie, Pa. and of Geneva located at the north end of Seneca lake. These cities, as is the case at Watkins, discharge their sewage into the lake from which they obtain their water supply and under certain conditions serious epidemics of water borne typhoid have occurred in these cities, in the past although now their supplies are protected by efficient methods of purification.

In addition to the contamination from the village, itself there are also the possibilities of contamination due to the discharge of sewage from the large salt plant about 1½ miles down the lake on the west shore and from lake steamers or other boats passing in the vicinity of the intake.

These possibilities for contamination were pointed out in the report of Professor Ogden who recommended that the authorities at Watkins make studies for a filter plant or disinfecting plant for their water supply. Apparently no effort has been made by the village to carry out these recommendations nor is it evident that the village authorities have realized the potential danger of existing conditions.

This Department, however, in issuing a permit to the village for the extension of their sewer system has required that the village submit plans for the interception and treatment of the sewage of the village before October, 1915. Treatment of the sewage although of great value in reducing the contamination reaching the lake cannot be considered as affording complete safety to the water supply.

At the time of his inspection Dr. Crum collected samples of water from the high and low pressure systems and from the spring water supply and the results of the analyses of these samples together with others made in the past by the Division of Laboratories and Research will be found in the appended table.

From the inspection it was apparent that the spring water supply was free from sources of contamination and this is borne out by the analytical results.

These analyses of the lake supply show a water slightly colored, clear and very hard. The figures for nitrogen in its different forms indicate a moderate amount of decomposing and decomposable organic matter. The figures for chlorine while very high are due to the influence of salt deposits and so may be considered normal for the water of the lake. At times the total numbers of bacteria are moderate while at other times they are excessive. Organisms of the B. coli type are present in 10 c.c. in about 50 per cent. of the samples, absent in 1 c.c. in all but 3 samples and present in 1/10 c.c. but once. Such results indicate that although the sanitary quality of the water supply is comparatively satisfactory much of the time, there are other times when active contamination occurs and at such times there is possibility for actual infection.

Although no undue prevalence of typhoid has occurred in this village it cannot be stated with any degree of certainty that such will continue to be the case in the future. With the right combination of circumstances, and given a typhoid case or typhoid carriers in the village it is very probable that sometime the village will undergo a serious outbreak of typhoid unless radical steps are taken to protect the quality of the water supply. The experience of Geneva and of the Willard State Hospital both of which are situated on this lake show what may occur to Watkins. Both places have in the past infected their own water supply and both have suffered typhoid epidemics as a consequence. In view of the above facts the following conclusions may be drawn:

1. That the recommendations of the previous report have not been carried out by the village authorities.
2. That the discharge of untreated sewage into the lake by the village of Watkins is a serious menace to the sanitary quality of its own water supply.
3. That in addition to the contamination caused by the discharge of sewage into the lake there also exists opportunity for contamination from passenger boats and other sources.
4. That while treatment of the sewage is a necessary step and will reduce the amount of contamination in the lake, further protection must be given by a water purification plant of some kind.

I would therefore recommend that the village authorities be advised to carry out at once the following measures for the protection of their water supply:

1. Carry out the requirement of this Department in respect to the submission of plans for sewage treatment.
2. Consider at once the installation at the earliest possible time of a modern filtration plant.
3. Install immediately, pending the construction of the filter plant, apparatus for the sterilization of the supply with hypochlorite of lime or liquid chlorine.

Respectfully submitted,

THEODORE HORTON,
Chief Engineer

ALBANY, N. Y., *April* 13, 1915

RESULTS OF WATER ANALYSES

Abbreviations used to describe odors of water: 0, none; 1, very faint; 2, faint; 3, distinct; 4, decided; 5, strong; 6, very strong; a, aromatic; d, disagreeable; e, earthy; f, fishy; g, grassy; m, musty; v, vegetable

Municipality	County	Source of supply	Date of collection	Physical				Chemical (Parts per Million)											Bacteriological			
						Odor		Solids			Nitrogen as—						Hardness			B. Coli Type (+ = present, — = absent)		
				Color	Turbidity	Cold	Hot	Total	Loss on ignition	Mineral residue	Free ammonia	Albuminoid ammonia	Nitrites	Nitrates	Oxygen consumed	Chlorine	Total	Alkalinity	Bacteria per c.c.: gelatin 20°, 48 hours	10 c.c.	1 c.c.	1-10 c.c.
Watkins	Schuyler	Tap, public supply	2/ 3/10	Tr.	Tr.	....	....	227	21	206	.002	.052	.002	0.04	1.69	55.00	122.8	......	1,000	—	—	—
Watkins	Schuyler	Tap, public supply	5/10/10	5	Cl.	....	....	227	21	206	.006	.068	.001	0.20	2.30	48.75	102.8	99.0	110	+	—	—
Watkins	Schuyler	Tap, public supply	6/ 8/10	3	Cl.	....	....	225	34	191	.006	.072	.002	0.14	3.00	53.00	100.0	95.0	44	—	—	—
Watkins	Schuyler	Tap, public supply	7/14/10	2	Cl.	....	....	216	55	161	.004	.012	.001	0.10	0.70	50.00	111.4	94.0	2,300	—	—	—
Watkins	Schuyler	Tap, public supply	9/15/10	Tr.	Tr.	....	....	238	44	194	.018	.082	.002	0.24	0.90	53.75	97.2	94.0	200	+	—	—
Watkins	Schuyler	Tap, public supply	10/28/10	3	Cl.	....	....	231	35	196	.030	.008	Tr.	0.20	0.20	54.00	88.6	......	60	+	—	—
Watkins	Schuyler	Tap, public supply	1/16/11	Tr.	Cl.	....	....	161	10	151	.002	.056	.001	0.50	0.80	53.00	120.0	105.0	250	—	—	—
Watkins	Schuyler	Tap, public supply	2/ 8/11	Tr.	Cl.	....	....	227	45	182	.004	.034	.001	0.18	1.20	56.00	111.4	93.0	4,600	+	+	—
Watkins	Schuyler	Tap, public supply	4/12/11	Tr.	Cl.	....	....	226	40	186	.004	.072	Tr.	0.14	0.60	55.00	114.2	96.0	50	—	—	—
Watkins	Schuyler	Tap, public supply	6/13/11	5	Cl.	....	....	245	47	198	.004	.064	.001	0.02	1.40	52.32	140.0	99.0	12,000	+	+	+
Watkins	Schuyler	Tap, public supply	7/19/11	Tr.	Cl.	....	....	300	71	229	.008	.022	.002	0.30	1.40	54.00	120.0	95.0	270	+	—	—
Watkins	Schuyler	Tap, public supply	9/15/11	1	Cl.	....	....	245	47	198	.004	.028	.001	0.20	1.70	56.25	120.0	94.0	20	+	—	—
Watkins	Schuyler	Tap, public service	11/ 2/11	5	Cl.	....	....	238	31	207	.004	.054	.001	0.24	0.90	57.50	114.2	99.0	1,000	+	—	—
Watkins	Schuyler	Tap, public supply	1/10/12	5	Cl.	....	....	237	25	212	.036	.068	.001	0.40	1.00	59.50	145.8	112.0	50	—	—	—
Watkins	Schuyler	Tap, public supply	2/12/12	Tr.	Tr.	....	....	242	71	171	.012	.072	Tr.	0.40	0.70	61.00	105.8	101.0	1,200	—	—	—
Watkins	Schuyler	Tap, public supply	3/21/12	5	Cl.	....	....	216	21	195	.016	.070	Tr.	0.36	1.00	52.00	102.8	100.0	1,800	+	—	—
Watkins	Schuyler	Tap, public supply	4/23/12	Tr.	Cl.	....	....	209	19	190	.004	.054	.001	0.26	0.10	52.50	108.6	101.0	650	—	—	—
Watkins	Schuyler	Tap, public supply	10/ 8/12	5	Cl.	....	....	241	31	210	.006	.054	.001	0.26	1.40	54.00	135.0	110.0	2,200	—	—	—
Watkins	Schuyler	Tap, public supply	11/27/12	5	Cl.	....	....	248	31	217	.008	.072	Tr.	0.26	1.40	59.00	151.4	107.0	70	+	—	—
Watkins	Schuyler	Tap, public supply	2/ 8/13	Tr.	Cl.	1 v.	1 v.	230	....	....	.004	.064	Tr.	0.26	1.30	62.00	120.0	102.0	40	0+3—	0+3—	0+3—
Watkins	Schuyler	Tap, public supply	3/22/13	5	Cl.	1 v.	1 v.	257	....	....	.014	.082	Tr.	0.30	1.20	52.00	111.4	101.0	2,400	1+2—	0+3—	0+3—
Watkins	Schuyler	Tap, public supply	5/ 3/13	5	Tr.	2 v.	2 v.	236	....	....	.008	.062	Tr.	0.16	1.20	60.00	111.4	100.0	3,000	0+3—	0+3—	0+3—
Watkins	Schuyler	Tap, public supply	6/25/13	Tr.	Cl.	2 v.	2 v.	272	....	....	.010	.066	Tr.	0.30	0.70	58.00	97.2	96.0	*......	0+3—	0+3—	0+3—

* Delayed in transit

Watkins	Schuyler	Tap, public supply	5/ 2/14	Tr.	Tr.	2 v.	2 v.	232	19	213	.022	.070	Tr.	0.30	1.60	61.00	97 2	97.0	220	0+3—	0+3—	0+3—
Watkins	Schuyler	Tap, public supply	5/11/14	Tr.	Tr.	1 v.	1 v.	250	27	223	.008	.054	Tr.	0.34	1.20	60.00	105.8	97.0	160	0+3—	0+3—	0+3—
Watkins	Schuyler	Tap, low service	1/25/15	Tr.	Cl.	2 v.	2 v.	208	13	195	.052	.018	Tr.	0.10	2.50	60.00	134.2	100.0	15	0+3—	0+3—	0+3—
Watkins	Schuyler	Tap, low service	1/25/15																15	0+3—	0+3—	0+3—
Watkins	Schuyler	Tap, high service	1/25/15																160	3+0—	1+2—	0+3—
Watkins	Schuyler	Tap, spring water supply	1/25/15	Tr.	Cl.	2 v.	2 v.	301	17	284	.050	.014	Tr.	1.00	2.00	19.00	264.5	192.0	50	0+3—	0+3—	0+3—

WELLSBURG

HERMANN M. BIGGS, M.D., *State Commissioner of Health:*

A reinspection of the public water supply of Wellsburg was made on February 5, 1915, by Dr. H. H. Crum, sanitary supervisor of district "R" and the information relative to the present condition of the supply was obtained by him. A full report of a previous investigation made by the Engineering Division in 1912 will be found on page 762 of the thirty-third annual report of this Department.

The water supply is derived from four driven wells located in the southwestern part of the village, the water being pumped to an equalizing and storage reservoir on a hill to the east of the wells. The description of the wells, method of development and water works system in general remain practically the same as at the time of the previous inspection. The population of the village is about 500 and the daily water consumption is about 50,000 gallons. The water works are owned and operated by the village.

The possibility for contamination of the wells was discussed at length in the previous report. The danger of active contamination reaching the wells from the privies at the houses within a few hundred feet radius of the wells and from other sources was clearly pointed out. It was also shown that there was possibility of contamination of the water in the reservoir due to surface wash from pasture lands. It was, therefore, recommended:

1. That on account of the danger of possible pollution of the public water supply derived from the present wells by the population on the immediate watershed, the board of water commissioners of the village consider the development of a new source of public water supply either from wells more favorably situated or from other adequate and safe sources.
2. That pending the establishment of a new and safe source of water supply and during the use of the present wells, no cesspools, manure piles or other accumulations of organic matter be allowed to remain on the region immediately surrounding the wells; that no manurial fertilizers be placed on the land near the wells, and that all privies in this region be removed or provided with removable watertight containers.
3. That the reservoir be adequately protected from surface wash by the construction of deep and suitable trenches and embankments on the uphill side, enclosed by a strong fence to be maintained at all times so as to effectively prevent cattle or other animals from polluting the water.

From the report of Dr. Crum it appears that none of these recommendations have been carried out.

At the time of his inspection samples of water were collected by Dr. Crum from various points in the distribution system and the results of the analyses of these samples together with others made in the past by the Division of Laboratories and Research will be found in the appended table. These analyses show a water usually colorless, clear and moderately hard. The bacterial results show rather high total numbers of bacteria and organisms of the B. coli type, frequently in 10 c. c.

The high total counts in many cases may be due to the fact that the samples were 48 hours or more reaching the laboratory. However the occurrence of B. coli, although in comparatively small amounts, indicates a certain amount of active contamination of animal or human origin. Whether this contamination is due to surface wash into the reservoir or to contamination of the ground water supply it is impossible to state definitely.

In view of the above facts the following conclusions may be drawn:

1. That none of the recommendations of this Department have been carried out by the local authorities.

2. That owing to the possibility of contamination of the ground water and of the waters of the reservoir the need for these recommendations still exists.

I would, therefore, recommend that the village authorities be advised to give their immediate attention toward the carrying out the earlier recommendations as given in detail in the body of this report.

Respectfully submitted,

THEODORE HORTON,
Chief Engineer

ALBANY, N. Y., *April 28*, 1915

RESULTS OF WATER ANALYSES

Abbreviations used to describe odors of water: 0, none; 1, very faint; 2, faint; 3, distinct; 4, decided; 5, strong; 6, very strong; a, aromatic, d, disagreeable; e, earthy; f, fishy; g, grassy; m, musty; v, vegetable

Municipality	County	Source of sample	Date of collection	Physical				Chemical (Parts Per Million)											Bacteriological			
						Odor		Solids			Nitrogen as—						Hardness		Bacteria per c.c.: gelatin 20°, 48 hours	B. Coli Type + = present — = absent		
				Color	Turbidity	Cold	Hot	Total	Loss on ignition	Mineral residue	Free ammonia	Albuminoid ammonia	Nitrites	Nitrates	Oxygen consumed	Chlorine	Total	Alkalinity		10 c.c.	1 c.c.	1-10 c.c.
Wellsburg	Chemung	Tap, public supply	10/31/12	Tr.	Tr.	....	....	116	22	94	.010	.032	.002	0.44	0.90	3.75	77.1	77.0	500	+	—	—
Wellsburg	Chemung	Tap, public supply	11/29/12	Tr.	Cl.	....	....	125	24	101	.010	.020	Tr.	1.00	1.10	4.25	77.1	65.0	80	+	—	—
Wellsburg	Chemung	Tap, public supply	11/29/12	10	Cl.	....	....	120	23	102	.010	.018	.001	1.00	0.80	4.75	88.6	77.0	....	....	....	....
Wellsburg	Chemung	Tap, public supply	11/29/12	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	10	—	—	—
Wellsburg	Chemung	Tap, public supply	2/ 8/13	Tr.	Cl.	1 a.	1 a.	95	....	....	.006	.026	Tr.	0.60	0.80	2.25	68.6	54.0	*450	0+3—	0+3—	0+3—
Wellsburg	Chemung	Tap, public supply	3/22/13	Tr.	Cl.	1 v.	1 v.	115	....	....	.022	.020	Tr.	0.70	0.50	3.50	64.3	52.0	*450	0+3—	0+3—	0+3—
Wellsburg	Chemung	Tap, public supply	5/ 4/13	Tr.	Cl.	2 a.	2 a.	110	....	....	.010	.058	.001	0.60	0.80	3.00	57.1	50.0	*400	0+3—	0+3—	0+3—
Wellsburg	Chemung	Tap, public supply	6/25/13	Tr.	Tr.	1 v.	1 v.	100	....	....	.004	.028	.001	0.16	0.60	2.50	62.9	61.0	70	1+2—	0+3—	0+3—
Wellsburg	Chemung	Tap, public supply	5/ 2/13	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	*90	0+3—	0+3—	0+3—
Wellsburg	Chemung	Tap, public supply	2/ 4/15	Tr.	Cl.	1 v.	1 v.	65	9	56	.008	.006	Tr.	Tr.	3.10	4.75	52.9	52.0	*180	0+3—	0+3—	0+3—
Wellsburg	Chemung	Tap, public supply	2/ 4/18	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	*170	1+2—	0+3—	0+3—
Wellsburg	Chemung	Tap, public supply	2/ 4/15	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	*170	1+2—	0+3—	0+3—

* Samples were over 24 hours in reaching laboratory.

WESTFIELD

On September 14, 1915, a telegram was received from Dr. R. F. Foster, health officer of Westfield, Chautauqua county, requesting the temporary installation of the chlorination outfit of this Department, since the occurrence of several cases of typhoid fever in the village was attributed by him to an infection of the water supply. The emergency outfit of this Department was accordingly shipped by express to the village and was installed and put in operation by Mr. E. S. Chase, assistant engineer, on September 18.

Inquiry into the details of the typhoid fever outbreak brought the following facts to light: Eight cases of typhoid fever occurred in Westfield from about the middle of August to the date of the inspection, while subsequently two or three more cases have developed. These cases were located at various points in the village, were of various ages, no two had the same milkman and all used the village water, no other food or drink supply being used in common. A case of typhoid fever had occurred upon the watershed of the village supply at a farm about five or six miles above the intake, the house being located a few hundred feet from a branch of the main stream. The drainage from the privy at this house was toward the stream on a rather steep slope. The farmer who had the fever was sick for about two weeks before taking to his bed, and during this two-week period was engaged in farm work on various parts of his farm. About this time there occurred heavy rains which undoubtedly washed infection into the supply. This farmer was first taken sick about the 23d of July, but did not go to bed until about the 8th of August. The first case occurring in the village had a date of onset of about August 13. The evidence therefore points directly to an infection of the water supply as the primary cause of the outbreak in Westfield.

A full investigation of the public water supply of Westfield was made by the Engineering Division in July of the present year and the report upon this investigation had been transmitted to the village authorities on August 11. This report pointed out that the water supply which was derived unpurified from Chautauqua creek was subject to considerable contamination, both direct and indirect, from pasture lands, manure fields, barnyards, highways, toilets on railroad trains and privies located close to the creek or directly over it. It was, therefore, recommended that the village authorities take steps at once to eliminate and control the various sources of contamination upon the watershed, and, if necessary, apply to this Department for the enactment of rules and regulations for the sanitary protection of the watershed; that the village consider the installation of a modern filtration plant supplemented by liquid chlorine for final sterilization and that a competent sanitary engineer be employed to advise as to the best and most efficient means for developing the supply. Subsequently a request was received from the village authorities for the enactment of rules and regulations for the sanitary protection of the supply and these rules were in the process of preparation at the time of the outbreak and since that date a preliminary draft of such rules has been prepared and sent to the village authorities.

Upon the arrival of the assistant engineer in Westfield it was decided to install the chlorination apparatus at the intake well about 4 miles from the village in a deep water on Chautauqua creek. The apparatus used was a direct, manual control chlorinator manufactured by the Wallace and Tiernan Company. The actual time required for the installation of this apparatus was about three hours. From the intake the water flows through about 3 miles of 12-inch tile before entering the cast-iron main leading to the village. The actual water consumption in the village is unknown and the amount of water leaking from the tile pipe is undoubtedly considerable, consequently there were no accurate data upon which to base the amount of chlorine to be applied. It was assumed, however, that 500,000 gallons of water per day were passing through the intake and it was, therefore, decided to apply about 2 pounds of chlorine per day at an estimated rate of 0.5 parts per million by weight. On September 22, this amount was increased

to 3 pounds per day as the preliminary results of bacterial analyses indicated that an insufficient amount of chlorine was being applied to sterilize the supply efficiently.

Previous to the installation of the apparatus samples of water were collected; one from the creek opposite the intake, one from the second tap on the main leading to the village and the third from a tap in the center of the village. Several sets of samples were collected after installation of the apparatus and at the same points.

The analyses of these samples made by the Division of Laboratories and Research will be found in the table on page 696.

These analyses show clearly the decidedly insanitary and potentially dangerous character of the raw water. They also show the immediate, although not complete, reduction of bacteria in the water after treatment with liquid chlorine at the rate of 2 pounds per day. Upon the increase of the chlorine applied to 3 pounds per day the reduction of bacteria was materially improved and organisms of the B. coli type were practically eliminated.

Source of Sample	Bacteria per c. c.	B. Coli Type			Remarks
		10 c. c.	1 c. c.	1/10 c. c.	
Series A. Samples collected Sept. 18, 1915, before sterilization					
Chautauqua creek (bottle broken)	....	....	....	....	2 days in transit.
Tap A	18,500	3+ 0—	2+ 1—	1+ 2—	
Tap B	17,500	3+ 0—	3+ 0—	0+ 3—	
Series B. Samples collected Sept. 19, 1915. Chlorine, 2 lbs. per day					
Chautauqua creek	7,200	3+ 0—	3+ 0—	3+ 0—	
Tap A	650	3+ 0—	3+ 0—	3+ 0—	
Tap B	550	3+ 0—	3+ 0—	1+ 2—	
Series D. Samples collected Sept. 20, 1915. Chlorine, 2 lbs. per day					
Chautauqua creek	17,000	3+ 0—	3+ 0—	2+ 0—	
Tap A	120	3+ 0—	1+ 2—	0+ 3—	
Tap B	50	3+ 0—	1+ 2—	0+ 3—	
Series C. Samples collected Sept. 23, 1915. Chlorine, 3 lbs. per day					
Chautauqua creek	19,000	3+ 0—	2+ 1—	0+ 3—	
Tap A	5	1+ 2—	0+ 3—	0+ 3—	
Tap B	40	1+ 2—	0+ 3—	0+ 3—	

Note.— Portions of 10 c. c., 1 c. c., and 1/10 c. c. are examined for B. coli. The presence of this intestinal bacillus in the smaller volumes of water indicates dangerous pollution.

In view of the above facts the following conclusions may be drawn:

1. That the recent outbreak of typhoid fever in the village of Westfield was due to the infection of the public water supply of that village by a case of typhoid fever occurring upon the watershed.
2. That the installation and operation of the emergency chlorination apparatus of this Department brought about an almost immediate elimination of infection as shown by the removal of the fecal organisms of the B. coli type.

About the middle of October we were advised that the village of Westfield had entered into a contract to purchase a permanent apparatus for disinfecting the water supply with liquid chlorine.

WESTFIELD

HERMANN M. BIGGS, M.D., *State Commissioner of Health:*

An investigation of the public water supply of the village of Westfield, Chautauqua county, was made on July 8, 1915, by Mr. E. S. Chase, assistant engineer in this Department accompanied and aided by Dr. R. F. Foster, health officer, and Mr. John Piehl, superintendent of water works.

Westfield is an incorporated village with a population of about 3,000 located in the northwestern part of Chautauqua county on Lake Erie and on the Lake Shore & Michigan Southern railroad. The village is in the center of the grape growing district of this state and there are two large juice factories in the village. The village is provided with a complete sewerage system and disposal plant constructed and put into operation in recent years.

The public water supply of Westfield is derived from Chautauqua creek, the intake being located about 3½ miles south of the village center. The water is distributed to the village by gravity through about 15 miles of water mains ranging in size from 4 to 10 inches in diameter. These works were constructed about 1890 under the direction of Mr. George W. Patterson, who designed the system. Practically the entire population is furnished with the supply although the average daily consumption is unknown. There are about 800 service taps of which only 50 are metered. The pressure in the village is approximately 90 to 95 pounds per square inch.

The intake consists of three lines of 12-inch tile laid with open joints in the gravel stratum forming the bed of Chautauqua creek. These tiles are laid at a depth of about 5 feet below the bed of the creek, at which depth rock is encountered. The water collected by these tiles flows into a concrete well about 6 x 10 feet in plan and 15 feet deep. From this well a 12-inch tile pipe conducts the water for a distance of about 2,000 feet down the stream from which point the water is carried to the village through two 10-inch cast-iron mains. At the point where the cast-iron mains begin there are two Holley filters, so-called, which are not now in use and which were probably never of much value in purifying the supply as they consisted simply of beds of gravel.

At time of low water some difficulty has been experienced in obtaining a sufficient quantity of water by means of the present intake system. It is therefore proposed to construct a submerged dam across the creek in order to intercept the flow of the stream at all times. This dam will extend to bed rocks and will be located just below the present collecting tile.

Provision for storing excess of water collected over that consumed is accomplished by means of a small reservoir located on a sidehill about 1 mile south of the village center. This reservoir is formed by damming a natural hollow by means of a low earthen embankment. This reservoir is approximately 200 x 250 feet in plan, has a 12-foot average depth with a capacity of about 2,000,000 gallons. The water works system is owned and operated by the village under the direction of the board of water commissioners of which Mr. J. J. Hartsell is president and Mr. John Piehl is superintendent.

The watershed area of Chautauqua creek above the intake is approximately 23 square miles in area. About 2 miles above the intake the stream flows through a narrow gully with steep slopes. The greater portion of the watershed, however, is very hilly and of irregular contour and shape. This area is drained by numerous smaller streams tributary to Chautauqua creek. From 15 to 20 per cent. of the area is wooded and the remainder is devoted to agriculture and grazing. The soil is a clay loam overlying rock strata of shale. The slopes are fairly steep and the run-off at times of rainfall very rapid.

The total population upon this watershed may be estimated at approximately 625, or about 27 per square mile. There are 125 houses scattered along the various highways traversing the watershed. These dwelling are farm houses with accompanying barns and outbuildings. One small hamlet (Summerdale), is located near the eastern boundary of the watershed. A

branch of the Pennsylvania railroad passes through the eastern portion of the watershed and crosses tributary streams at five points.

Considerable opportunity for contamination of the main stream and its tributaries exists due to surface wash from manured fields, pasture lands and highways. There are a great many head of cattle pastured on the watershed which have access to the streams for drinking, wading and wallowing. There is also possibility for contamination from toilets of the passenger coaches of the railroad trains at several points where the railroad crosses the streams. Although the entire watershed area was not covered at the time of the inspection that portion which was covered is representative of the entire watershed. At the time of the inspection opportunity for contamination of the supply by animal or human wastes was noted at 10 specific points. One of these sources of contamination was refuse dumped on the edge of a small tributary. In three cases barnyards were located close to the streams in such a way as to be sources of contamination at times of rainfall. At another place the sink drain discharged at the edge of a tributary. In four cases privies were located within 100 feet of tributaries. In another case a horse shed was located on the edge of a stream. The worst condition, however, discovered was a privy located on the edge of the bank overhanging the main stream. This privy was constructed in such a way that excreta would be discharged directly into the stream. This privy was located at a house near the Lyons Mill about 4 miles above the water works intake. The seriousness of this condition cannot be too strongly emphasized, for should this privy be used by a typhoid case or a typhoid carrier, the infection of the creek would be practically sure to result in an epidemic of typhoid fever in the village. That the village has escaped such an epidemic is undoubtedly due to the fact that as yet no case of typhoid or typhoid carrier has used this privy.

In January of the present year a proposition was submitted to the voters of the village seeking authorization for the purchase of land adjacent to the intake. The proposition was defeated largely because it was felt that the expenditure for such purpose was not warranted in view of the problematical value of such a course. While at present the purchase of land upon the watershed cannot be considered as a sufficiently adequate means to protect the supply, it would be well for the village to obtain control of land at those points where the danger of serious contamination is most acute. Any large expenditures for land should, however, be made subsequent to the installation of modern purification processes and should be made with the view of keeping contamination reaching the stream at a minimum.

At the time of the inspection a sample of water was collected from a tap in the village the analysis of which together with others made in the past by the Division of Laboratories and Research will be found in the appended table.

These analyses show hard water, somewhat colored and at times very turbid. The bacterial counts ars usually high and occasionally excessive even for a surface supply. Organisms of the B. coli type are found always in 10 c. c., frequently in 1 c. c. and occasionally in 1/10 c. c. samples. Such results cannot be considered as satisfactory from a sanitary standpoint and while the large bacterial content and the presence of B. coli may be largely due to contamination of animal origin, it is evident that the results are also partly due to the direct contamination of the stream by human excreta.

In view of the above facts the following conclusions may be draw:

1. That the public water supply of Westfield is subject to considerable indirect contamination from the surface wash, from pasture land, manured fields, barnyards, highways and from the vicinity of dwellings and other farm buildings.

2. That the supply is also subject to direct contamination of animal origin due to the wallowing of cattle in Chautauqua creek and its tributaries.

3. That the water supply is subject to direct contamination of human origin from privies located close to the creek or directly over it, and possibly from toilets on passenger trains at those points where the railroad crosses the stream or its tributaries.

4. That the so-called filters act simply as strainers for the removal of some of the grosser solids, but accomplish no appreciable bacterial purification.

5. That the watershed above the present intake of the water works is of sufficient area to afford the village a water supply of ample quantity if properly developed.

I would, therefore, recommend:

1. That the village authorities take steps at once to eliminate and control the various sources of the contamination upon the watershed and if necessary apply to this Department for the enactment of rules and regulations for the sanitary protection of their watershed.

2. That the village consider at once the installation of a modern filtration plant supplemented by liquid chlorine for final sterilization.

3. That in order to obtain a properly designed and constructed filter plant and in order to secure the best and most efficient means of developing the supply, the village should employ a competent sanitary engineer.

Respectfully submitted,

THEODORE HORTON,
Chief Engineer

ALBANY, N. Y., *August* 11, 1915

RESULTS OF WATER ANALYSES

Abbreviations used to describe odors of water: 0, none; 1, very faint; 2, faint; 3, distinct; 4, decided; 5, strong; 6, very strong; a, aromatic; d, disagreeable; e, earthy; f, fishy; g, grassy; m, musty; v, vegetable

Municipality	County	Source of sample	Date of collection	Physical				Chemical (Parts Per Million)											Bacteriological			
						Odor		Solids			Nitrogen as—						Hardness			B. Coli Type + = present — = absent		
				Color	Turbidity	Cold	Hot	Total	Loss on ignition	Mineral residue	Free ammonia	Albuminoid ammonia	Nitrites	Nitrates	Oxygen consumed	Chlorine	Total	Alkalinity	Bacteria per c.c.: gelatin 20°, 48 hours	10 c.c.	1 c.c.	1-10 c.c.
Westfield	Chautauqua	Tap, public supply	4/ 7/08	13	5	....	....	97	....	....	.014	.088	Tr.	0.12	2.15	1.25	60.0	......	850	+	+	......
Westfield	Chautauqua	Raw water	8/14/08	2	4	....	....	193	....	....	.028	.032	.001	0.04	1.35	1.37	134.0	134.0	1,200	+	+	+
Westfield	Chautauqua	Filtered water	8/14/08	1	1	....	....	191	....	....	.006	.024	.001	0.08	0.85	1.37	134.2	130.0	20,000	+	+	+
Westfield	Chautauqua	Tap, public supply	1/22/09	2	40	....	....	140	35	105	.030	.228	.002	0.80	3.20	1.50	55.7	26.0	15,500	+	+	—
Westfield	Chautauqua	Tap, public supply	3/22/10	12	10	....	....	84	22	62	.006	.052	.002	0.60	1.80	0.75	57.1	32.0	6,600	+	—	—
Westfield	Chautauqua	Kent reservoir	9/19/10	....	....	....	....	....	....	....	....	....	....	....	....	......	......	......	100	+	+	—
Westfield	Chautauqua	Tap, public supply	9/19/10	2	5	....	....	201	56	145	.006	.092	.002	0.02	0.33	1.75	128.6	128.0	5,800	+	......	—
Westfield	Chautauqua	Tap, public supply	12/15/10	15	2	....	....	115	33	82	.012	.056	.002	0.40	2.20	1.00	72.9	67.0	500	+	+	+
Westfield	Chautauqua	Tap, public supply	2/ 1/11	15	15	....	....	88	30	58	.018	.076	.001	0.50	2.90	1.00	47.1	35.0	4,700	+	+	—
Westfield	Chautauqua	Tap, public supply	4/17/11	10	5	....	....	93	23	70	.004	.088	.001	0.30	2.90	1.75	60.0	52.0	700	+	—	—
Westfield	Chautauqua	Tap, public supply	12/ 8/11	Tr.	Tr.	....	....	93	17	76	.024	.046	.001	0.30	1.70	2.50	64.3	60.0	100	+	+	—
Westfield	Chautauqua	Tap, public supply	3/ 7/12	10	Cl.	....	....	105	19	86	.014	.045	Tr.	0.40	1.70	1.50	77.1	65.0	60	+	—	—
Westfield	Chautauqua	Tap, public supply	4/16/12	20	240	....	....	224	21	203	.006	.133	Tr.	0.16	4.50	1.50	67.1	48.0	6,500	+	+	+
Westfield	Chautauqua	Tap, public supply	9/21/12	15	5	....	....	167	14	153	.002	.032	.001	0.06	2.50	1.25	128.8	111.0	1,500	+	+	—
Westfield	Chautauqua	Tap, public supply	11/ 8/12	15	25	....	....	139	28	111	.014	.086	.001	0.08	3.50	1.00	77.1	61.0	525	+	+	—
Westfield	Chautauqua	Tap, public supply	12/11/12	10	Tr.	....	....	114	15	99	.006	.026	Tr.	0.16	1.80	1.50	74.3	65.0	100	+	—	—
Westfield	Chautauqua	Tap, public supply	1/22/13	....	....	....	....	112	....	....	.020	.090	Tr.	0.70	3.40	4.75	48.6	31.0	1,500	+	—	—
Westfield	Chautauqua	Tap, public supply	2/19/13	....	Tr.	....	....	112	....	....	.080	.080	Tr.	0.32	1.60	1.50	81.4	76.0	30	+	—	—
Westfield	Chautauqua	Tap, public supply	4/2/13	15	15	....	....	91	....	....	.022	.054	Tr.	0.20	1.50	1.00	58.6	42.0	3,800	+	+	—
Westfield	Chautauqua	Tap, public supply	5/21/13	10	1	....	....	160	....	....	.010	.032	.001	0.08	1.20	1.50	114.2	107.0	275	+	—	—
Westfield	Chautauqua	Tap, public supply	7/ 9/13	12	10	....	....	167	....	....	.004	.054	.001	0.16	1.60	2.25	128.6	114.0	31,000	+	+	+
Westfield	Chautauqua	Tap, public supply	4/14/14	15	7	1 v.	1 v.	81	15	66	.010	.054	Tr.	0.22	3.00	1.00	44.3	37.0	165	3+0—	1+2—	0+3—
Westfield	Chautauqua	Tap, public supply	6/ 8/15	Tr.	Tr.	1 v.	1 v.	153	5	148	.006	.016	.002	0.10	1.60	1.50	145.8	121.0	125	1+2—	0+3—	0+3—
Westfield	Chautauqua	Tap, public supply	7/ 8/15	5	50	2 a.	2 a.	172	40	132	.002	.058	.001	0.06	6.03	1.25	84.3	66.0	1,600	3+0—	3+0—	3+0—

WHITEHALL (Typhoid)

HERMANN M. BIGGS, M.D., *State Commissioner of Health:*

An investigation of an outbreak of typhoid fever in the village of Whitehall, Washington county, was made by the Engineering Division in February, 1915.

Whitehall is an incorporated village of about 5,000 inhabitants located at the extreme southern end of Lake Champlain, 80 miles north of Albany. It is on the Montreal division of the D. & H. R. R. and is the junction point for the Rutland division of this railroad. The village is largely a railroad center and has one large silk mill and one or two lumber mills.

Previous investigations of typhoid outbreaks in this village have been made by this Department in the years 1904, 1906 and 1907. The evidence of these investigations pointed very strongly to the public water supply as the cause of the typhoid outbreaks which have occurred here in the past. The reports of these earlier investigations will be found on page 263 of the twenty-seventh annual report and on page 388, Vol. I of the twenty-eighth annual report of this Department.

Notification of the recent undue prevalence of typhoid in this village was first received on the afternoon of February 5, when Dr. F. M. Meader, director of the Division of Communicable Diseases was notified by Dr. J. S. Guinan, the health officer of Whitehall, of the occurrence of some 20 cases of typhoid in the village. As the past investigations had pointed strongly to the water supply as the source of the previous outbreaks of typhoid and as the information available indicated the same source in the present instance, the matter was referred to the Engineering Division for investigation on February 6 and during the morning of that day arrangements were made to obtain an emergency chlorination apparatus for the sterilization of the public water supply should the preliminary field investigation bear out the assumption that the water supply was the cause of the outbreak. Mr. E. S. Chase, assistant engineer in this Department, was detailed to proceed at once to Whitehall and study the conditions in connection with the outbreak and to make such arrangements as might be necessary for the installation of the sterilization apparatus.

In addition to the work carried on by this Division Dr. Chas. S. Prest, sanitary supervisor of district "G" supervised the collection of the epidemiological data by the supervising nurse, Mrs. Chichester, of this Department.

The preliminary findings of the investigation indicated the strong probability of the public water supply being the source of the infection. Accordingly conferences were held with the health officer and the board of trustees and the necessity for prompt action towards the sterilization of the water supply was urged. As a result of these conferences a formal request was made on February 6 by the local board of water commissioners to this Department for the installation of the temporary chlorination apparatus. On February 9 this apparatus was installed by Mr. H. K. Davies of the Wallace and Tiernan Company, makers of the apparatus. On February 10 the pumping from the regular source of supply, the Mettawee river, was stopped and the water was obtained from the reservoir, this reservoir impounding a surface supply from the upland sources free from contamination. On February 13 the river water was again pumped into the village mains but with treatment by chlorine gas at the approximate rate of 0.4 parts per million.

The following tables give the results of bacteriological analyses of the water supply of Whitehall for the past few years made by the Division of Laboratories and Research together with the results of analyses made since the installation of the chlorination apparatus.

TABLE NO. 1

RESULTS OF BACTERIOLOGICAL WATER ANALYSES, AT WHITEHALL BEFORE AND AFTER CHLORINATION

SOURCE OF SAMPLE	Date collected	Bacteria per c. c.	B. Coli Type		
			10 c. c.	1 c. c.	1/10 c. c.
Tap, public supply	11/10/10	500	+	+	—
Tap, public supply	3/ 7/11	1,000	+	+	—
Tap, public supply	10/ 3/11	2,200	+	+	+
Tap, public supply	11/10/10	300	+	+	+
Tap, public supply	12/15/11	9,200	+	+	+
Tap, public supply	2/ 6/12	350	+	+	+
Tap, public supply	3/12/12	12,000	+	+	+
Tap, public supply	4/16/12	350	+	—	—
Tap, public supply	5/14/12	500	+	+	+
Tap, public supply	9/ 3/12	2,700	+	+	—
Tap, public supply	10/22/12	300	+	+	—
Tap, public supply	12/ 3/12	400	+	—	—
Tap, public supply	1/6/13	1,700	3+0—	3+0—	0+3—
Tap, public supply	2/10/13	210	1+2—	0+3—	0+3—
Tap, public supply	5/ 5/13	9,500	3+0—	1+2—	0+3—
Tap, public supply	6/16/13	9,600	3+0—	0+3—	0+3—
Tap, public supply	7/21/13	2,400	3+0—	3+0—	0+3—
Tap, public supply	5/11/14	775	3+0—	3+0—	0+3—
		Chlorinati	on apparat	us installed	
Mettawee river	2/ 9/15	11,500	3+0—	3+0—	3+0—
Tap, engineer's house	2/ 9/15	3,700	3+0—	3+0—	1+2—
Tap, Wilsey farm	2/ 9/15	2,400	3+0—	3+0—	1+2—
Manville's drug store	2/ 9/15	*25	0+3—	0+3—	0+3—
Mt. Supply reservoir	2/10/15	600	0+3—	0+3—	0+3—
River supply treated	2/10/15	†90	0+3—	0+3—	0+3—
Mettawee river	2/13/15	‡550	3+0—	3+0—	1+2—
Tap, engineer's house	2/13/15	‡6	0+3—	0+3—	0+3—
Tap, farm	2/13/15	‡8	0+3—	0+3—	0+3—
Tap, Manville's drug store	2/13/15	‡10	0+3—	0+3—	0+3—
Mettawee river	2/17/15	§7,400	3+0—	3+0—	1+2—
Tap, engineer's house	2/17/15	§41	0+3—	0+3—	....
Tap, farm	2/17/15	§37	0+3—	0+3—	....
Tap, Manville's drug store	2/17/15	§55	0+3—	0+3—	....
William street schoolhouse well	2/17/15	216	3+0—	2+1—	1+2—

* This small count due to small amount chlorine introduced during installation of apparatus.
† Chlorine 0.5 p. pm.
‡ Chlorine: 0.4 p. p. m. 2.2 lbs. per 24 hours.
§ Chlorine: 0.7 p. p. m. 3.75 lbs. per 24 hours.

This table shows clearly the highly contaminated condition of the Whitehall water supply in the past and of the Mettawee river at all times. The total number of bacteria is high and the presence of organisms of the B. coli type in samples as small as 1/10 cubic centimeters indicates concentrated contamination by animal and human excrement. The results since the beginning of the chlorine treatment are very satisfactory. The total numbers of bacteria have been reduced to a very small number in the treated water and organisms of the B. coli type have been destroyed. While it is impractical and of little value to test water for the presence or absence of specific disease germs, it is known that such germs are destroyed, as a rule, more easily than the ordinary bacteria present in water. It is therefore, evident that the removal of so large a per cent. of the total number of bacteria from the raw water and the destruction of B. coli means that the germs of typhoid fever if present in the river water, have also been killed.

In addition to the steps taken to make safe the public water supply it seemed essential to advise and warn the public in regard to the precautions and safeguards necessary to control the further spread of the disease. On Sunday, February 7, notices were read in all of the local churches advising the boiling of all water used for drinking and culinary purposes, and also

the pasteurizing of milk. On February 8 a general letter of instructions and warning to taxpayers and residents of the village was given to the press and also distributed on hand bills to every house in the village. This letter contained specific directions and precautions to be followed by everyone in the village with reference to boiling the water and milk, isolation of cases of typhoid fever, use of disinfectants and other essential matters. A copy of this letter accompanies this report.

A supply of antityphoid vaccine, prepared by the Division of Laboratories and Research, was furnished the health officer for free distribution by this Department. Immunization was urged and carried out by the physicians in many instances where there was danger of contact infection. Including the company of National Guard at Whitehall there have been somewhat over 100 persons immunized in the village.

Since typhoid fever has been prevalent in Whitehall in previous years and in order that a comparison may be made with the present outbreak the following tables give the number of reported cases of typhoid fever by months beginning with the year 1908 and the deaths from typhoid each year since 1906.

TABLE NO. 2

CASES OF TYPHOID REPORTED FROM THE VILLAGE OF WHITEHALL

	Jan.	Feb.	Mar.	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Total
1908	4	4	6	3	0	6	2	1	0	0	0	1	27
1909	0	1	1	0	0	0	0	0	0	0	0	0	2
1910	0	4	1	0	0	0	0	0	0	0	0	0	5
1911	0	1	0	0	0	0	0	0	0	0	0	0	1
1912	0	0	11	13	0	0	2	0	0	6	0	0	32
1913	2	3	2	2	1	0	0	1	1	1	0	3	16
1914	3	2	4	0	0	0	0	0	0	0	0	0	9
Total	9	15	25	18	1	6	4	2	1	7	0	4	92

TABLE NO. 3

DEATHS FROM TYPHOID IN WHITEHALL

YEAR	1907	1908	1909	1910	1911	1912	1913	1914
Deaths	4	4	2	1	3	4	1	3

These tables show clearly that the village has suffered from an excessive amount of typhoid during the past few years. During the period 1907 to 1914 inclusive the death rate from typhoid in Whitehall has averaged approximately 50 per 100,000 population living while the corresponding rate for the state at large has been but 13.9.

Table 2 shows that as a rule the greatest amount of typhoid occurs during the winter or early spring. This winter incidence is characteristic of waterborne typhoid.

From these two tables it is evident that all cases of typhoid occurring in Whitehall in the past have not been reported. In 1911 although there were three deaths from typhoid but one case was reported. Furthermore, experience has shown that the proportion of deaths from typhoid to cases is about 1 to 10. During the years 1908 to 1914 inclusive there were 18 deaths from typhoid and 86 reported cases of typhoid. It is therefore very probable that this number of reported cases represents but about one-half of the number that actually occurred. This conclusion is borne out by the fact that during

the present investigation at least 4 cases of typhoid were found to have occurred during the last six months of 1914 and yet none of these cases had been reported. The failure to promptly report cases of typhoid fever is a distinct violation of regulations 1 and 2, chapter II of the Sanitary Code.

In order to obtain a detailed history of each case in the present outbreak and also in order that instructions, where necessary, might be given regarding the care of patients and the precautions for the prevention of the spread of the diseases every reported case was visited by the supervising nurse, Mrs. Chichester. The data obtained by her in respect to milk supply, water supply, etc., is given in detail in the appended tables. This table may be summarized first so as to show the prevalence and intensity of the outbreak as indicated by the probable dates of onsets as follows:

TABLE NO. 4

PROBABLE DATES OF ONSET

DATE	December			January							
	19	23	28	6	10	13	15	17	18	20	22
Cases.........	1	1	1	2	1	3	2	3	2	4	1

DATE	January						February			
	23	25	26	27	28	29	6	7	12	13*
Cases...............	6	1	2	1	2	1	1	1	1	1

* No subsequent cases up to February 26.

These dates of onset are also shown graphically on Fig. I which will be found accompanying this report. It will be seen that the outbreak covered a rather prolonged period. The peak of the outbreak, however, occurred about January 23, and, allowing 10 days to two weeks for the period of incubation of the typhoid germ in the human system, the specific period of infection apparently occurred about the first week in January. The cases having dates of onset in December undoubtedly received infection at an earlier date than the majority of cases. Some of the later cases also may be due to contact or other secondary infection.

With reference to the milk supply the cases of typhoid on each milk dealer's route may be summarized as follows:

TABLE NO. 5

TYPHOID CASES ON MILK ROUTES

DEALER OR SUPPLY	Cases
Butler	6
J. Norton	6
R. Norton	6
Beckwith	4
Mixed	4
Unknown	4
Monty	3
E. Norton	2
Borden	1
Condensed milk	1
Own cows	1

It is evident that the cases are so well scattered along the routes of each dealer that the milk supply as the cause of the outbreak is eliminated. As practically all the milk sold in the village is dipped milk there is no possibility of infection through returned milk bottles. It is significant that the outbreak was not of an explosive nature as is true in cases of milk infection, and it is also significant that there seems to be no preponderance of cases among very young children as is usually the case with a milk epidemic.

The following table shows the age distribution at Whitehall and during two epidemics elsewhere, one due to water and the other to milk:

TABLE NO. 6

TABLE SHOWING PER CENT. OF TYPHOID CASES AT SPECIFIED AGE

AGE IN YEARS	Whitehall, N. Y.	Epidemic caused by water, Waterville, Me.	Epidemic caused by milk, Stamford, Conn.
0 to 10	21	17	35
10 to 20	42	38	24
20 to 30	13	26	23
30 to 40	13	10	12
40 to 50	11	4	5
50 to 70	....	5	1
Total	100	100	100

The figures for Waterville and Stamford are from "Typhoid Fever" by Geo. C. Whipple.

With the elmination of the milk supply as a cause of the disease there remains only the public water supply which was used by practically every case either at home or at work although there are a number of private wells in use in the village. One section of the village known as the Elbow has no cases of typhoid among the population of possibly 200 and it is extremely significant that this section of the village is supplied by wells and springs and not by the public water supply.

Summarizing the data in respect to the water supply used by each one of the 38 cases of typhoid the following facts are obtained:

Twenty-nine cases used regularly unboiled village water.

Three cases lived in country and used water from the Mettawee river due to wells going dry. May also have used village water.

Two cases said not have used village water; both cases children and one case probably caused by contact infection.

One case used boiled water at home but drank unboiled water at social gatherings.

One case lived on farm in country and used well water, but came to the village frequently and drank village water.

One case used boiled village water or spring water. Date of onset late and possibility of secondary infection through some unknown channel.

One case said not to have used village water but mother did washing for an earlier case; possibly secondary infection.

While all these cases may not be due to infected village water, the data as set forth above is very conclusive as to the majority of the cases being caused thereby. The three cases living in the country and using the river water is confirmatory evidence of its infection.

In 1910 a special investigation of the public water supply of the village of Whitehall was made by the Engineering Division the report of which will be found on page 586 of the thirty-first Annual Report of this Department.

The supply is derived from the Mettawee river at a point about 2 miles southeast of the village center. The water is received in a pump well from which it is delivered to the village by direct pumping into the mains. Since the previous report all services have been metered, of which there are at present about 800, and the waste and water consumption have been markedly decreased. The present daily water consumption is approximately 600,000 gallons of which about 200,000 gallons is used by the railroad.

The watershed of the Mettawee river above the waterworks intake is approximately 207 square miles. The stream rises in the hills of Vermont and follows a meandering course northwesterly through an irregular valley devoted largely to farming. The total population of this watershed is estimated at 12,000. While a large portion of this population is scattered throughout the numerous farms upon this area there are several hamlets and villages located near the stream or its tributaries. The largest of these villages is Granville with a population of 4,000 located about 8 miles above the waterworks intake of Whitehall. This village is partly sewered and the discharge from these sewers flows into the Mettawee river. It is also said that a sewer from a farm house discharges into the river a few hundred feet above the Whitehall intake.

In the report on the investigation of the water supply made in 1910 the numerous opportunities for dangerous contamination of the water supply of Whitehall were clearly pointed out and it was strongly recommended that the Mettawee river be abandoned as a source of supply in favor of some other source of unquestioned quality or else the river water be subjected to some form of adequate purification. Following this investigation Mr. Wm. B. Landreth, consulting engineer, was employed to study into the problem of obtaining a safe and adequate gravity supply from the hills west of the village. Mr. Landreth's report showed that such a supply could be obtained from either one or two sources. No action however, was taken by the village towards securing such a supply or towards the purification of the Mettawee river.

In view of the fact that sewers in Granville discharge into the Mettawee river it is evident that the cases of typhoid in that village are extremely liable to infect the water supply of Whitehall. In this connection the following table showing the prevalence of typhoid in Granville is very significant in consideration of the continued prevalence of typhoid in Whitehall.

TABLE NO. 7

CASES OF TYPHOID REPORTED FROM THE VILLAGE OF GRANVILLE

	Jan.	Feb.	Mar.	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Total
1908	0	0	0	0	0	0	0	0	0	0	1	0	1
1909	0	0	0	0	0	0	0	0	0	0	0	1	1
1910	0	0	0	0	0	0	0	0	1	1	0	0	2
1911	0	0	0	0	0	0	0	1	0	2	0	0	3
1912	1	1	0	1	1	1	0	0	0	0	0	0	5
1913	0	0	0	3	2	0	1	0	0	0	0	0	6
1914	0	0	0	0	0	0	0	0	0	2	1	1	4
1915	3	0	0	0	0	0	0	0	0	0	0	0	3

TABLE NO. 8

DEATHS FROM TYPHOID IN GRANVILLE

YEAR	1907	1908	1909	1910	1911	1912	1913	1914
Deaths	1	0	2	1	1	0	0	0

These tables show that while typhoid is not as prevalent in Granville as in Whitehall cases occur every year. Furthermore it is also very probable that only one-half of the cases actually occurring are reported. Table 7 shows that cases of typhoid have occurred very recently in Granville, cases being reported for the months of October, November and December, 1914, and for January, 1915, thus indicating the probability of infection of the river water during the past few months prior to the outbreaks in Whitehall.

Granville also uses unfiltered Mettawee river water for its public water supply. Whether the river is infected above Granville is of course indeterminate at present although the continuation of typhoid in that village throws strong suspicion to say the least, upon its water supply. Even though the Mettawee river is infected above Granville it is evident that that village must contribute further infection and the instance of so many cases in Granville immediately prior to the outbreak in Whitehall is extremely significant.

The rapidity with which typhoid germs may be carried down stream to the Whitehall intake must be a considerable factor in determining the intensity of infection received in the water supply. In this connection the following table showing weather and rainfall conditions during December and January is also very significant.

TABLE NO. 9

WEATHER CONDITIONS AT ALBANY; U. S. WEATHER BUREAU RECORDS

	December, 1914											
	3	7	8	10	13	14	19	21	23	24	25	29
Mean temp'ture	47	31	32	30	31	30	29	31	16	12	8	23
					INCHES							
Precipitation....	.02	.20	.06	.01	.51	.16	.17	.54	.01	.04	.02	.10
Snow or rain....	R.	R. & S.	R.	S.	R. & S.	R.	R.	S.	S.	S.	S.	R.

	January, 1915												
	2	6	7	12	15	17	18	19	22	23	25	28	31
Mean temp't.	24	30	46	32	38	38	40	40	18	28	28	27	20
							Inches						
Precipitation.	.07	.02	.56	.87	.10	.07	.34	.03	.06	.26	.24	.06	.08
Snow or rain.	S.	R.	R.	S.	R.	R.	R.	R.	S.	R. & S.	S.	S.	S.

From this table it will be seen that rainfall and thawing weather occurred at various times during both December and January. It is said that the rainfalls on January 7 and 23 were followed by floods in the Mettawee river. It seems very probable therefore that these floods carried a concentration of infectious material down the river to the intake of the Whitehall water works, being followed by the recent outbreak of typhoid. While there is undoubtedly more or less infection present in the water at nearly all times, causing sporadic cases among those of weak resistance, it is reasonable to assume that an excessive number of cases is caused when the infection is in a more concentrated and virulent form as would be true at times of flood.

While the continuance of typhoid at Whitehall may be partly explained

by the effect of small amounts of infection in the water supply upon persons of low resistance there are also factors in the village itself which may be of considerable influence in bringing about the spread of the disease. The village is only partly sewered, and outside privies are numerous many of which are in an insanitary condition. Garbage collection is not carried out systematically and in many cases is simply thrown upon the ground. There are many stables in the village and it is said that in season flies occur in abundance. The possibility of transmission of typhoid through the agency of flies may explain the scattering cases occurring throughout the year. There are also many private wells and in a built-up neighborhood there must be numerous opportunities for their contamination. A single analysis of the well at the William street schoolhouse shows such contamination. The ice supply of the village is obtained from the Mettawee river and a few hundred feet above the point of which the ice is obtained there are three cases of typhoid. The houses in which these cases occur have privies near the river or its tributary, Mud creek, and there exists some danger of infectious material being washed upon the ice. As every case of typhoid is potentially a cause of infection for others and as many recovered cases become carriers of the germ, once typhoid fever occurs to any extent in the village such insanitary conditions as described above tend to make the disease self-perpetuating.

In the present instance the outbreak is clearly due to water infection. All evidence leading to this conclusion has been detailed above and may be summarized as follows:

1. The nonexplosive character of the outbreak.
2. The even distribution of the cases throughout the village, save in those portions not supplied with village water. (See accompanying map.)
3. The distribution of the cases along the route of no one milk man and the comparatively few young children affected thus eliminating milk.
4. The nonoccurrence of the disease in those sections of the village not supplied with the village water.
5. The occurrence of three cases living in the country outside the village who used Mettawee river water.
6. The occurrence of typhoid outbreak shortly after the floods in the Mettawee river and the occurrence of cases of typhoid in Granville showing the possible source of the infection of the river water.

In view of the facts set forth in this report the following conclusions may be drawn:

1. That the majority of cases of typhoid in the present epidemic at Whitehall have been caused by the infection of the public water supply.
2. That the large amount of typhoid which has occurred almost constantly at Whitehall during the past ten years has been largely due to the water supply.
3. That insanitary conditions in the village itself, such as outside closets, prevalence of flies in season and contaminated wells, tend to spread the disease.
4. That the treatment of the water supply with liquid chlorine is a feasible and efficient temporary means of destroying all disease germs in the water providing the application occurs in sufficient amounts and under careful supervision.
5. That sterilization alone is insufficient to improve the physical quality of the water which is frequently turbid and this sterilization should be considered as adequate treatment only until such time as the village can arrange to install some method of filtration.

I would therefore recommend:

1. That the village authorities, physicians and citizens continue to take every precaution to prevent the spread of the disease.

2. That the village install at once a permanent type of chlorination apparatus.

3. That in addition to the installation of the sterilization plant the village should consider at once the construction of a modern filtration plant at as early a date as possible.

4. That the village engage a sanitary engineer to advise and carry out methods for the improvement of the general sanitary condition of the village by providing adequate sewerage, proper garbage disposal and such other sanitary reforms as may be found necessary.

The conservation of health is a matter of vital importance to every inhabitant of Whitehall and the prevention of typhoid fever is a primary duty of the village officials. If the recommendations outlined above are carried out there is no doubt that typhoid fever can be controlled and eventually eliminated from Whitehall.

Respectfully submitted,

THEODORE HORTON,
Chief Engineer

ALBANY, N. Y., *February* 26, 1915

TYPHOID DATA—WHITEHALL, WASHINGTON COUNTY, N. Y., FEBRUARY, 1915

Case	NAME	Age	Sex	Address	Probable date of onset	Water supply	Milk supply	Remarks
1	Mrs. B. Morris	36	Female	La Fayette street	Dec. 19	Village	J. Butler	Recovered.
2	Wm. Gordon	17	Male	Gilmore street	Dec. 23	Village	Monty	Recovered.
3	Charles Smith	11	Male	Canal street	Dec. 28	Village	Monty	Came home from Staten Island Dec. 24.
4	Mrs. Henry Long	40	Female	Poultney street	Jan. 6	Village	Butler	....
5	Mrs. Helen Fields	33	Female	Canal street	Jan. 6	Village	Edward Norton	....
6	Mrs. Agnes Agnew	23	Female	William street	Jan. 10	Village	Condensed milk; John Norton	Dead February 2.
7	Mrs. E. Holden	43	Female	Canal street	Jan. 13	Village	Rufus Norton	....
8	Geo. Genevous	29	Male	Canal Boat north of village	Jan. 13	Village	R. Norton	....
9	Charles Kingsley	23	Male	William street	Jan. 13	Mettawee river	R. Norton	Came in from country; well dry; used river water.
10	Anna Sheldrick	31	Female	William street	Jan. 15	Mettawee river	J. Norton	Dead; well went dry, used river water.
11	Willie Miller	11	Male	Canal street	Jan. 15	Village	Butler	....
12	Helen Dean	19	Female	Canal street	Jan. 17	Village	Butler	....
13	Lotta Morck	21	Female	East William street	Jan. 17	Village	R. Norton	....
14	Tracy Normandin	9	Male	Mountain street	Jan. 17	Village	Butler	....
15	Genevieve Perry	18	Female	Mountain street	Jan. 20	Village	J. Norton	....
16	Helen Mason	6	Female	West street	Jan. 18	Village	Butler	....
17	Bertha Harper	16	Female	La Fayette street	Jan. 18	Village	J. Norton	....
18	Gladys Hammond	10	Female	Cliff street	Jan. 20	Village	J. Norton	Taken sick at Canal street; moved 1/24.
19	P. A. Cowen	5	Male	Second avenue	Jan. 20	Well and village (?)	R. Norton	Taken sick at Canal street; moved 1/25.
20	Mrs. Andre Cappalica	18	Female	Queen street	Jan. 22	Village	Beckwith	....
21	Tulip Carter	18	Female	Church street	Jan. 23	Village	Various	Recovered.
22	Mrs. Mabel Chase	45	Female	Canal street	Jan. 23	Village	? Norton	....
23	Lilian Hoy	9	Female	Mountain street	Jan. 23	Village	J. Norton	....
24	Lena Mitchell	17	Female	William street	Jan. 23	Mettawee river	Bottled Bordens	Hired girl at Sheldrick's in country, (case 10); used river water.
25	Miss E. Brett	33	Female	Canal street	Jan. 23	Village	E. Norton	....
26	William Edmonds	17	Male	Adams street	Jan. 23	Mettawee river	? Norton	....

27	Irving Huestis	16	Male	Canal street	Jan. 26	Village	Beckwith	
28	Gladys Chase	20	Female	Canal street	Jan. 25	Village	? Norton	
29	Bishop McFarren	34	Male	Town of Whitehall, E. Bay	Jan. 26	Well on farm and vil.	Own cows	
30	Lilian Austin	4	Female	Jermain street	Jan. 27	Village	R. Monty	
31	Helen Cowen	3	Female	Second avenue	Jan. 28	Well; village ?	R. Norton	Possible contact case; (sister of No. 19).
32	Le Roy Renoys	10	Male	N. William street	Jan. 28	Village	Beckwith	
33	Loretta Scott	6	Female	Clinton and Center streets	Jan. 29	Village	Condensed milk	
34	Ormond Sisson	9	Male	Adams street	Jan. 20	Village	Beckwith	
35	David Orr	41	Male	William street	Feb. 6	Village	? Norton	
36	Jane Holcomb	12	Female	William street	Feb. 7	Village	Borden & J. Norton	Water boiled at home; drank village water at social gatherings.
37	Charles Tinsley	14	Male	Gilmore street	Feb. 12	Village ?	Monty & Stoddard	Mother washed for Case No. 18; said not to use village water.
38	Russell Brown	17	Male	William street	Feb. 13	Village ?	J. Norton	Said never to drink unboiled village water; sp'g water.

WHITEHALL

HERMANN M. BIGGS, M.D., *State Commissioner of Health:*

An inspection of the water supply chlorination plant at Whitehall was made on August 16, 1015, by Mr. E. S. Chase, assistant engineer, at the request of the health officer, Dr. S. S. Guinan, following the occurrence of a few cases of typhoid in the village during the summer.

In February, 1915, a serious outbreak of typhoid fever occurred in Whitehall which, upon investigation by the Department, was attributed to the infection of the public water supply derived unpurified from the Mettawee river. At the time of this outbreak a temporary apparatus for the sterilization of the supply was installed by this Department and operated until about the middle of May, 1915. Subsequently the village purchased apparatus for the permanent sterilization of the supply.

The apparatus installed by the village is a type "A" manual control chlorinator solution feed apparatus, manufactured by Wallace & Tiernan Co. of New York city. The concentrated chlorine solution is applied directly to the water passing through the suction line to the pumps. The rate of chlorine application is determined by the measuring device connected with the apparatus and is not checked by the loss of weight in the cylinder.

At the time of the inspection chlorine was being added to the raw water at the rate of 1.45 pounds per 24 hours. The pumps were operating at the rate of 780,000 gallons per day and consequently the chlorine was being applied to the water in the proportion of 0.23 parts per million by weight. The cylinder which was then connected to the apparatus had been in use since the 24th of May, or for 81 days, allowing for 3 days when the apparatus was not in use and the supply was being obtained from the reservoir. Assuming that this cylinder was nearly empty it will be seen that the average rate of application of chlorine had been less than 1.25 pounds per day. It is evident from these figures that during this interval there must have been times that the amount of chlorine applied to the water had been insufficient to efficiently sterilize it. It is also stated on good authority that visitors to the plant have found the apparatus not in use. These facts are particularly significant in view of the occurrence of 3 or 4 scattering cases of typhoid occurring in the village during the summer.

At the time of this inspection samples of raw water and of the sterilized water at various points in the distribution system were collected and the results of the analyses of these samples, together with others made earlier in the year by the Division of Laboratories and Research, will be found in the following table.

TABLE SHOWING RESULT OF STERILIZATION OF WHITEHALL WATER SUPPLY

SOURCE OF SAMPLE	Bacteria	B. COLI TYPE		
		10 c. c.	1 c. c.	1/10 c. c.
A. Samples collected Feb. 9, 1915, before sterilization.				
Mettawee river	11,500	3+0—	3+0—	3+0—
Tap, Eng. house	3,700	3+0—	3+0—	1+2—
Tap, Wilsey farm	2,400	3+0—	3+0—	1+2—
Tap, Manville's drug store	*25	0+3—	0+3—	0+3—
B. Samples collected Feb. 13, 1915. †Chlorine 0.4 p. p. m.				
Mettawee river	550	3+0—	3+0—	1+2—
Tap, Eng. house	6	0+3—	0+3—	0+3—
Tap, Wilsey Farm	8	0+3—	0+3—	0+3—
Tap, Manville's drug store	10	0+3—	0+3—	0+3—
C. Samples collected Feb. 17, 1915: ‡Chlorine 0.7 p. p. m.				
Mettawee river	7,400	3+0—	3+0—	1+2—
Tap, Eng. house	41	0+3—	0+3—	....
Tap, Wilsey farm	37	0+3—	0+3—	....
Tap, Manville's drug store	55	0+3—	0+3—	....
D. Samples collected Aug. 16, 1915: §Chlorine 0.23 p. p. m.				
Mettawee river	2,000	3+0—	3+ 0—	3+0—
Tap, Eng. house	35	0+3—	0+ 3—	0+3—
Tap, Wilsey Farm	35,000	3+0—	3+ 0—	0+3—
Tap, Manville's drug store	3,500	1+2—	0+ 3—	0+3—
Tap, D. & H. R. R. station	130	0+3—	0+ 3—	0+3—

* This small count due to small amount of chlorine introduced during installation of apparatus.
† 2.2 lbs. per 24 hours.
‡ 3.75 lbs. per 24 hours.
§ 1.45 lbs. per 24 hours.

The analyses show conclusively that with adequate amounts of chlorine efficient sterilization of the supply may be obtained. The results of the analyses of the recent series, while somewhat inconsistent, indicate clearly that the amount of chlorine being applied was insufficient to bring about uniform and efficient sterilization. It is evident therefore that unless sufficient amounts of chlorine, as recommended, are applied at all times there is the strongest possibility of imperfectly sterilized water reaching the consumers.

In view of the above facts the following conclusions may be drawn:

1. That, until such time as it is possible to construct a modern filtration plant or to secure a new supply of unquestionably good sanitary quality, the present supply may be rendered reasonably safe if the sterilizing apparatus is properly and continuously operated and adequate amounts of chlorine are applied to the water.

2. That during the past few months there have been times when sufficient chlorine has not been added to the raw water and at the time of the inspection the rate of chlorine application was below the safe minimum.

3. That there is at present no adequate means for checking up the accuracy of the control apparatus nor the amount of chlorine actually applied.

I would therefore recommend:

1. That the amount of chlorine applied to the water should be about twice that applied at the time of the inspection, or at the rate of between

0.4 and 0.5 parts per million. This rate would, with the present consumption of water, require the application of approximately 3 pounds of chlorine per day.

2. That scales should be provided upon which to set the cylinders of chlorine in order that daily weighings may be made and a check kept of the actual amount of chlorine applied.

3. That weekly reports of the weighings of chlorine and the amount of water pumped should be kept by the board of water commissioners.

Respectfully submitted,

THEODORE HORTON,
Chief Engineer

ALBANY, N. Y., *September* 23, 1915

WHITE PLAINS

HERMANN M. BIGGS, M.D., *State Commissioner of Health:*

A reinspection of the public water supply of White Plains was made by Dr. L. W. Hubbard, sanitary supervisor of district "T," on October 2, 1914. and the following report is based largely upon information furnished by him. A previous report of a full investigation of this supply made by the Engineering Division in 1909 will be found on page 365, volume II of the thirtieth annual report of this Department.

The water supply of White Plains is obtained from two reservoirs impounding the waters of a small surface stream, from four shallow dug wells, from three driven wells, and from the Drew system of driven wells at North White Plains. The present population of White Plains is approximately 20,000, practically all of which is supplied by the public water supply. The daily water consumption is 1,500,000 gallons distributed through 42 miles of cast-iron pipe ranging in size from 3 to 16 inches in diameter. There are 3,200 service taps, 99 per cent. of which are metered. The standpipe mentioned in the 1909 report collapsed and has been replaced by a new standpipe with a capacity of 400,000 gallons. The waterworks are owned and operated by the village.

The reservoirs impounding the surface supply remain the same as described in the previous report. The watershed area of 541 acres has been purchased by the village. There is only one house on this watershed. It is occupied by one person and is located a considerable distance from the reservoirs. The privy at this house is provided with a concrete vault.

The four dug wells now in use are 25 feet in diameter, 25 feet deep, and are constructed of brick. Two other wells formerly in service have been cut off and are not now in use. These abandoned wells are located near a small brook, which receives drainage from the vicinity of houses located on the Kensico road. Two houses which were noted in the earlier report as being located on the slope below the lower dam from which there might be contamination of the ground water tributary to the wells have been abandoned, one of them being removed. An area of about 20 feet in radius around each of the shallow wells has been filled in with sand and gravel.

The brook which flows in the vicinity of these wells probably receives some contamination due to drainage from a populated area. The wells which are in use, however, are from 500 to 600 feet from this brook. Each well is provided with a separate suction line to the pumps as is also the lower reservoir. In case of turbid water in the reservoir, the water from it may be drawn through one of the wells called the "feed" well.

The three new driven wells are located about 800 to 900 feet northwest of the pumping station in the vicinity of the shallow wells, two of which are 180 feet deep and the other 115 feet. Apparently there are no opportunities for contamination of these wells. The capacity of the wells is approximately 300,000 gallons daily.

The Drew wells are located in a level plain about one-half mile northwest of the North White Plains station and 100 feet west of the Bronx river.

These wells are from 90 feet to 120 feet deep and there is apparently little opportunity for contamination. From these wells 600,000 gallons per day are pumped directly into the village mains.

Regular analyses of the supply are made by Mr. J. Roemer, consulting chemist, who in addition to the analytical determinations makes quarterly inspections of the watershed. During July, 1914, the analyses made by him indicated the occurrence of B. coli in samples of tap water as small as 1/10 c.c. Individual samples of the water were therefore taken from the four shallow wells and from the two reservoirs. These analyses showed considerable contamination of well No. 1 and slight contamination of the "feed" well. The samples from the other wells and reservoirs showed the absence of B. coli. The occurrence of B. coli in the tap water continued for about ten days. Soon after the determination of the contamination of the two wells, they were shut off and were kept out of service for about six weeks, although the analyses indicated the occurrence of B. coli for only a few days.

No reason could be discovered for this sudden and temporary contamination of these two wells.

The earlier report of this Department pointed out that the analyses of various samples taken prior to the date of that report indicated a water of questionable purity, although it was impossible to determine at that time the exact point at which contamination took place. It was therefore recommended:

1. That the village authorities remove all preventable pollution such as derived from the small stream receiving sewage and other pollution from the houses on the Kensico road and northwest of the road and privies located between the reservoir dam and the walls.
2. That a further study, such as detailed inspection of the watershed and analyses of samples of water from the different wells and from the two reservoirs, should be made to locate the point of pollution.
3. That in case this pollution could not be effectively removed or determined, it would be advisable to consider the filtration of the supply.

From the report of Dr. Hubbard, it appears that in general the recommendations of this Department have been acted upon, although no steps have been taken for the purification of the supply.

Numerous analyses of this supply have been made in the past by the Division of Laboratories and Research and the results of these analyses will be found in the appended table. These analyses show a water usually clear and colorless and comparatively hard. The figures are somewhat higher than normal for this region probably indicating the pollution of the ground waters to some extent by the resident population in this vicinity. On the whole, the bacterial counts are moderate and organisms of the B. coli type have occurred in 10 c. c. volumes in the case of three samples and in 1 c. c. volumes in the case of one sample only out of 19 taken during the past four years. In view of the conditions surrounding these wells and the continuous satisfactory analytical results over a considerable period of time, it is rather difficult to discover the cause to which the acute contamination in July, 1914, might be attributed. There is of course the possibility of accidental or wilful contamination of the wells from some chance visitor in the vicinity.

In view of the above facts, the following conclusions may be drawn:

1. That the recommendations of this Department have been in general acted upon by the village authorities.
2. That the present supply is of a reasonably satisfactory quality under ordinary conditions, but due to the comparatively large population resident in the neighborhood and the possibility of the contamination of the ground water from accidental or wilful pollution, the wells and reservoirs supplies can not be considered absolutely free from danger of contamination at all times and under all conditions.

I would therefore recommend that the village authorities take steps to install as soon as possible some means of sterilization of their supply with hypochlorite of lime or liquid chlorine.

Respectfully submitted,

THEODORE HORTON,

Chief Engineer

ALBANY, N. Y., *May* 17, 1915

RESULTS OF WATER ANALYSES

Abbreviations used to describe odors of water: 0, none; 1, very faint; 2, faint; 3, distinct; 4, decided; 5, strong; 6, very strong; a, aromatic; d, disagreeable; e, earthy; f, fishy; g, grassy; m, musty; v, vegetable

Municipality	County	Source of sample	Date of collection	Physical				Chemical (Parts per Million)												Bacteriological			
						Odor		Solids			Nitrogen as—						Hardness				B. Coli Type + = present, — = absent		
				Color	Turbidity	Cold	Hot	Total	Loss on ignition	Mineral residue	Free ammonia	Albuminoid ammonia	Nitrites	Nitrates	Oxygen consumed	Chlorine	Total	Alkalinity	Bacteria per c.c. gelatin 20°, 48 hours	10 c.c.	1 c.c.	1-10 c.c.
White Plains...	Westchester....	Tap, public supply.........	1/ 4/11	5	3	....	....	110	27	83	.030	.032	.002	0.20	0.45	3.00	78.6	76.0	500	+	+	—
White Plains...	Westchester....	Tap, public supply.........	3/22/11	5	Cl.	....	....	111	24	87	.006	.018	.003	0.40	0.50	5.00	80.0	79.0	90	—	—	—
White Plains...	Westchester....	Tap, public supply.........	5/11/11	5	Cl.	....	....	142	31	101	.016	.054	.001	0.50	1.40	4.00	90.0	87.0	20	—	—	—
White Plains...	Westchester....	Tap, public supply.........	6/23/11	Tr.	Cl.	....	....	130	15	115	.098	.012	.001	0.80	1.20	3.75	75.7	69.0	170	+	—	—
White Plains...	Westchester....	Tap, public supply.........	10/18/11	Tr.	Cl.	....	....	188	41	147	.004	.022	.001	0.30	0.10	3.25	130.0	100.0	35	—	—	—
White Plains...	Westchester....	Tap, public supply.........	12/ 6/11	Tr.	Cl.	....	....	196	19	177	.006	.014	.001	0.80	0.50	5.00	128.6	101.0	20	—	—	—
White Plains...	Westchester....	Tap, public supply.........	1/18/12	15	Cl.	....	....	190	27	163	.020	.036	Tr.	0.50	0.70	4.00	80.6	80.0	20	+	—	—
White Plains...	Westchester....	Tap, public supply.........	2/21/12	Tr.	Cl.	....	....	167	18	149	.014	.030	.001	0.72	0.80	4.75	102.8	89.0	30	—	—	—
White Plains...	Westchester....	Tap, public supply.........	3/27/12	Tr.	Cl.	....	....	167	15	142	.006	.036	Tr.	0.52	0.30	4.50	120.0	73.0	1,600	—	—	—
White Plains...	Westchester....	Tap, public supply.........	5/ 4/12	1	3	....	....	180	31	149	.008	.038	Tr.	0.50	0.70	4.25	111.4	75.0	20	+	—	—
White Plains...	Westchester....	Tap, public supply.........	8/28/12	Tr.	Cl.	....	....	208	31	177	.002	.014	Tr.	0.90	0.45	5.00	151.0	103.0	450	—	—	—
White Plains...	Westchester....	Tap, public supply.........	10/16/12	Tr.	Tr.	....	....	173	26	147	.002	.038	Tr.	0.80	0.50	5.00	122.8	83.0	200	—	—	—
White Plains...	Westchester....	Tap, public supply.........	12/18/12	Tr.	Cl.	....	....	212	31	181	.008	.044	.001	0.80	1.00	5.25	142.8	101.0	425	—	—	—
White Plains...	Westchester....	Tap, public supply.........	1/22/13	Tr.	Cl.	....	....	200	....	....	.010	.034	Tr.	1.00	0.70	6.00	142.8	98.0	30	—	—	—
White Plains...	Westchester....	Tap, public supply.........	2/26/13	Tr.	Cl.	....	....	242	....	....	.010	.022	Tr.	0.80	0.10	5.50	157.2	109.0	20	—	—	—
White Plains...	Westchester....	Tap, public supply.........	4/10/13	Tr.	Cl.	....	....	235	....	....	.020	.020	Tr.	0.90	0.20	5.75	162.8	114.0	30	—	—	—
White Plains...	Westchester....	Tap, public supply.........	5/21/13	Tr.	Cl.	....	....	217	....	....	.010	.016	Tr.	0.70	0.40	4.25	131.4	100.0	20	—	—	—
White Plains...	Westchester....	Tap, public supply.........	7/ 2/13	Tr.	Tr.	....	....	217	....	....	.006	.024	.001	0.60	0.25	5.13	140.0	107.0	....	—	—	—
White Plains...	Westchester....	Tap, public supply.........	3/17/14	Tr.	Cl.	1 v.	1 v.	169	13	156	.006	0.01	Tr.	0.80	1.20	4.25	91.4	86.0	25	—	—	—

WHITESVILLE

HERMANN M. BIGGS, M.D., *State Commissioner of Health:*

An investigation of the public water supply of the village of Whitesville was made by Mr. C. M. Baker, assistant engineer, on August 10, 1915. Mr. Baker was accompanied and assisted in the work by Dr. John A. Conway, sanitary supervisor of district "K."

Whitesville is an unincorporated village of about 500 inhabitants, located in the town of Independence, Allegany county, on the N. Y. & Penn. R. R. about 22 miles southwest of Canisteo.

The water supply is owned and controlled by the Whitesville Water Company of which Mr. Dan Rollin is president. The supply is derived by gravity from springs located near the village on the side of the mountains. About 450 or 90 per cent. of the population are served with the water. Since there are no meters nor other method of measuring the quantity used no definite information could be obtained regarding the consumption. The water pressure in the village is approximately 96 pounds per square inch. There are about 2 miles of mains ranging in size from 2 to 6 inches in diameter.

The springs from which the water is derived are located on two different mountains. One large spring, known as the Harrigan spring from which the greater part of the supply is probably obtained, is located about 1½ miles northwest of the village. It is situated in a pasture and is not protected by a fence to keep cattle and other animals from its immediate vicinity. The spring is walled up with concrete, however, and the basin thus formed, which is about 6 feet square by 3 feet deep, is covered with boards. Drainage ditches are provided for diverting to some extent the surface wash from above the spring. There are no inhabitants above the spring and it is apparent that the only source of pollution is afforded by the pasturing in the vicinity. The water from this spring is piped directly to the village mains.

The other two springs known as the Rosa Springs, are located about 1 mile from the village. They are at a slightly lower elevation than the Harrigan spring and discharge into a small reservoir. The westerly and larger of the two springs is enclosed by a loose stone wall and covered with flag stone. The outlet pipe from this spring passes through the reservoir and extends about 30 feet into the main leading to the village. This pipe is considerably smaller than the main conduit and thus the water may flow directly from the reservoir into the village distributing system providing the flow from the Harrigan spring is less than the consumption, or the water from the Harrigan spring may flow into the reservoir if the water from this source exceeds the consumption. The other spring is enclosed by a concrete basin and the outlet discharges directly into the reservoir. The water from this spring, however, was not being used at the time of the inspection.

The reservoir is about 25 feet square and 6 feet deep in the center and this provides but little storage. There was some indication of algae growth in it at the time of the inspection although probably not sufficient to cause trouble. There is a substantial fence around the reservoir to prevent cattle from entering it.

The Rosa springs are protected from contamination in a similar manner to the Harrigan spring, that is, provided with drainage ditches but with no fences. There are no inhabitants above and thus the only permanent opportunity for pollution is from the cattle or other pastured animals in the vicinity.

Samples of water were collected from the various springs also from a tap in the village and sent to the Division of Laboratories and Research, the results of the analyses of which are given in the appended table.

The results of the analyses show that the water was practically clear and colorless and moderately soft. Considerable organic matter was present in the form of free and albuminoid ammonia and the figures for nitrates and chlorine were also somewhat high, thus indicating the presence of organic contamination, probably of animal origin. The bacterial counts were low

except in the sample collected from the west Rosa spring. Fecal organisms of the B. coli type were moderately prevalent further indicating contamination of animal origin, due probably to the inadequate protection of the springs.

In conclusion it is evident that, although the springs from which the water supply furnished by the Whitesville Water Company to the inhabitants of the village are subject to no permanent sources of contamination of human origin, they are inadequately protected from pollution from cattle and other pastured animals in the vicinity.

In view of the above the following recommendations may be made; that the water company provides suitable fences to keep cattle and other animals from the immediate vicinity of the springs, and also, that they provide and maintain adequate drainage ditches to divert at all times the surface wash from the springs.

Respectfully submitted,

THEODORE HORTON,
Chief Engineer

ALBANY, N. Y., *November* 5, 1915

REPORT OF WATER ANALYSIS FOR WHITESVILLE

SOURCE		Tap, center of village	Harrigan Spring	Rosa Springs	
				East	West
Collected on		8/10/15	8/10/15	8/10/15	8/10/15
Color		Trace	....	....	....
Odor, hot		1 v.	....	....	....
Odor, cold		1 v.	....	....	....
Turbidity		Trace	....	....	....
Solids, total		39	....	....	....
Loss on ignition		12	....	....	....
Mineral residue		27	....	....	....
Ammonia, free		.030	....	....	....
Ammonia, albuminoid		.032	....	....	....
Nitrites		Trace	....	....	....
Nitrates		1.60	....	....	....
Oxygen consumed		1.10	....	....	....
Chlorine		1.50	....	....	....
Hardness, total		24.70	....	....	....
Alkalinity		4.00	....	....	....
Bacteria per c. c.		40	40	45	550
B. coli type	10 c. c.	1+2—	2+0—	2+1—	0+3—
	1 c. c.	0+3—	0+3—	0+3—	0+3—
	1/10 c. c.	0+3—	0+3—	0+3—	0+3—

Results are expressed in parts per million. + Present. — Absent.

Abbreviations used to describe odors of water: 0, none; 1, very faint; 2, faint; 3, distinct; 4, decided; 5, strong; 6, very strong; a, aromatic; d, disagreeable; e, earthy; f, fishy; g, grassy; m, musty; v, vegetable.

WINDHAM

HERMANN M. BIGGS, M. D., *State Commissioner of Health:*

An investigation of the public water supply of the village of Windham, was made on September 15, 1915, by Mr. Morton F. Sanborn, assistant engineer. This inspector was assisted at the time of the inspection by Dr. C. D. Mulbury, health officer of the town of Windham and president of the water company; Mr. M. I. Tallmadge, secretary of the company; and Dr. S. L. Ford, supervisor of the town.

Windham is an unincorporated village located in the western part of the town of Windham and the central part of Greene county. It is about 33 miles southwest of Albany on Batavia kill which is a tributary of Schoharie

creek. It is about 9 miles from Hunter which is the nearest railroad station. The population of the village at the time of the inspection was estimated at about 450.

The public water supply is furnished by the Windham village water company and is used for household purposes and for fire protection. The works were designed by Mr. G. H. Vaughn of Stamford and were constructed by him in 1895.

The water is obtained from two springs from which it is conveyed to two reservoirs and is then discharged to the pipe line leading to the village. An auxiliary spring and small reservoir are located nearby and at a lower elevation than the main reservoirs. This auxiliary supply has never been used.

About 350 or 78 per cent. of the population are served by the water supply. There are about 100 houses in the village of which about 75 are connected with the supply. There are no meters in use in the village. The water is distributed through the village by gravity and the average pressure is about 85 pounds per square inch. There are about 1½ miles of water mains running from the springs to the reservoir and the village varying in size from 3 to 6 inches. There are 13 hydrants located in various places in the village. No definite figures on the daily consumption could be obtained although it was estimated by the secretary that the consumption amounts to about 100 gallons per capita or a total of 35,000 gallons per day.

There is no sewer system or method of sewage disposal in the village except local cesspools and septic tanks.

The two springs are about one mile north of the village and about 50 feet from the road. These springs are each surrounded by a stone wall, 4 feet in diameter and are covered with a metal plate secured by a padlock. These springs are also surrounded by an earthen embankment of tamped material to exclude surface wash. From each of the springs a 3-inch line of pipe extends to the reservoirs.

The auxiliary spring is located at the auxiliary reservoir which is below the other two reservoirs. This supply cannot be used when the principal supply is in use since water from the main reservoirs would overflow at the auxiliary spring and reservoir.

The two main reservoirs are side by side and are constructed of concrete. The old reservoir is 70 feet by 30 feet in plan and 8 feet deep and has a capacity of about 126,000 gallons. A new reservoir was constructed about five years ago and is 100 feet by 30 feet in plan and 8 feet deep and has a capacity of 252,000 gallons. Both reservoirs are covered with timber roofs. They are connected by pipes so that either of the reservoirs may be used as desired. The reservoirs are cleaned out once a year and the water mains are flushed out about twice a year.

The lower reservoir for the auxiliary supply is 10 by 30 feet in plan and 3 feet deep. The sides of the reservoir are constructed of concrete. The reservoir has an earth bottom and is partially open. The spring feeding this reservoir is located near the center of the reservoir.

Above the main springs there is practically no watershed although the area from which the springs may draw water might be as great as one-half square mile. The ground surrounding the springs is used for cultivation although the use of fertilizer on the ground is prohibited. There are no houses above these springs and the only pollution which might reach them would be from the highway which passes about 50 feet above the springs, from the cultivation of the fields near the springs and from the pasture on the other side of the road.

The soil is generally of a sand and gravel formation although somewhat impervious to the passage of water. The stone underlying this soil is generally of a sandstone type and is of a blue stone and red stone character.

The auxiliary spring is located in the middle of a pasture in which there are several pigs. It was stated by the president of the company that arrangements had been made to fence off several acres at this spring and that it would soon be done.

At the time of the inspection a sample of water was obtained from a tap in the village and the results of the analysis are shown in the appended table.

From these analyses it is evident that the water has a slight color, a small amount of turbidity and is very soft. The nitrates are somewhat high and show the presence of past pollution which has been well oxidized. The high oxygen consumed showed considerable carbonaceous matter. The bacterial count was quite high and bacteria of the B. Coli type were found in 1 c.c. samples which showed the presence of some pollution.

As a result of this investigation and of the above analyses the following conclusions may be drawn:

1. That the water supply while apparently maintained in an efficient condition, undoubtedly receives some pollution as is seen from the analyses and this pollution may be from one or more of the following sources:
   - (a) Cultivation of the fields around and above the springs.
   - (b) Pollution from the road above the springs.
   - (c) Pollution from the pasture on the opposite side of the road.
   - (d) Direct pollution of animal origin at the reservoirs.
2. That the water from the auxiliary supply at the time of the inspection was not suitable for use as a public water although with the fencing of the area surrounding the spring and proper protection from surface water and the covering of the springs this source would probably give a satisfactory supply.

In view of the above conclusions I would make the following recommendations:

1. That the possible sources of pollution be looked over and if necessary several acres above the spring be fenced to prevent cultivation or pasturing within the area.
2. That in case pollution is not removed some satisfactory method of filtration or sterilization be used to treat the water.
3. That several acres of the land around the auxiliary supply be fenced to prevent pasturing, that a cover be erected over the reservoir and that suitable provision be made to exclude surface wash from the reservoir.

Respectfully submitted,

THEODORE HORTON,
Chief Engineer

ALBANY, N. Y., *October* 22, 1915

REPORT OF WATER ANALYSIS FOR WINDHAM

Source		Tap, public supply
Color		3
Odor, hot		1 v.
Odor, cold		1 v.
Turbidity		3
Solids, total		85
Loss on ignition		65
Mineral residue		20
Ammonia, free		.004
Ammonia, albuminoid		.014
Nitrites		.001
Nitrates		0.80
Oxygen consumed		3.10
Chlorine		1.25
Hardness, total		15.60
Alkalinity		13.00
Bacteria per c. c.		50,500
B. coli type	10 c. c.	3 +0—
	1 c. c.	1 +2—
	1/10 c. c.	0 +3—

Results are expressed in parts per million. + Present. — Absent.

Abbreviations used to describe odors of water: 0, none; 1, very faint; 2, faint; 3, distinct; 4, decided; 5, strong; 6, very strong; a, aromatic; d, disagreeable; e, earthy; f, fishy; g, grassy; m, musty, v, vegetable.

WINDSOR

HERMANN M. BIGGS, M.D., *State Commissioner of Health:*

An investigation of the public water supply of the village of Windsor, Broome county, was made on June 29, 1915, by Mr. E. S. Chase, assistant engineer in this Department, accompanied and aided by Mr. H. A. Barton, superintendent and water commissioner of the village.

Windsor is an incorporated village of about 750 inhabitants located in the southern part of Broome county on the Susquehanna river. It is a station on the Pennsylvania division of the D. & H. R. R. and is about 15 miles east of Binghamton from which it may be reached by auto stage.

The public water supply of the village is derived from a small upland watershed about 2 miles northeast of the village. At times of drought, however, it is necessary to supplement this supply by pumping from a driven well located about one-quarter of a mile south of the village. An attempt is also made to collect water from several springs in the vicinity of the upland supply. The water works were constructed about the year 1900 and the well supply was purchased a short time afterwards. Practically the entire population is served by the supply although there is no information available relative to the actual amount of water consumed. The water from the upland supply is distributed by gravity through about 4 miles of cast-iron mains ranging in size from 4 to 8 inches in diameter. The well supply is distributed by pumping directly into the mains against the pressure maintained by an equalizing and storage reservoir connected with the system. There are in the neighborhood of 160 service taps of which only two are metered. The average pressure in the mains in the center of the village is about 70 or 75 pounds per square inch.

The upland supply is developed by the construction of a small masonry dam about 15 feet long and 2 feet high across a small intermittent brook. This dam diverts the water into a masonry chamber 5 feet x 8 feet in plan and 5 feet deep. From this chamber the water flows into an 8-inch main leading to the village, the intake end of this main being covered with a metal strainer.

There are also three sets of springs which are connected with the main leading to the village, but these springs contribute little, if any, water thereto due to the fact that the connecting pipes are very small and are filled with silt. Two of the groups of springs, far back in the wooded hills were not visited at the time of the inspection. The third group of springs is located in an open pasture lot. These springs are developed by constructing small masonry pits and conducting the water thus collected through small iron pipes to a central distributing well from which the water is carried by another small pipe line to the main, to the village. At the time of the inspection these springs were partly filled with mud and no water was being obtained from them. The top of the basins are flush with the surface of the ground and the springs are undoubtedly subject to surface wash at times of rainfall.

The well supply which is located below the village was developed about 35 years ago by a creamery company whose buildings were located nearby. The well together with the buildings was purchased by the village a few years ago. This well is 80 feet deep and has a 4-inch iron casing extending to an unknown depth but probably to rock. The strata through which the well passes are unknown although it is said that the well goes through alternate layers of loam, gravel, rock and finally into water-bearing gravel. When the pump is not in operation the water in the well rises nearly to the surface of the ground. The pumping station for the well supply is a one-story concrete structure 15 x 20 feet in plan. The pumping equipment consists of a Gould triplex 5-inch x 8-inch pump geared to a 10-horsepower Westinghouse induction motor, power being purchased from the local electric company. The capacity of this pump is 92 gallons per minute. An extra Gould triplex 4-inch x 6-inch pump, 45 gallon capacity is available but has not as yet been

connected to the motor. This well supply is used about 60 or 90 days through the year at irregular intervals according to the quantity of water available from the upland source.

The reservoir which acts for pressure equalization and storage is located on a side hill about one-quarter of a mile west of the pumping station. This reservoir is circular in cross section with vertical sides and is constructed of concrete. Its diameter is 60 feet and the average depth is 9 feet with a corresponding capacity of about 200,000 gallons. This reservoir is surrounded by an embankment so constructed that no surface drainage from the vicinity can enter it and is also surrounded by a high wire fence and by a low, fine mesh wire screen around its perimeter.

The watershed tributary to the surface water supply is 0.5 square miles in area. About 50 per cent. of this area is covered with a growth of hard wood timber and the remaining portion consists of cultivated land and pasture. There are but two dwellings upon this watershed both of which are located fully one-quarter of a mile from the stream. The number of inhabitants on the watershed is 5 or 10 per square mile. The chief source of contamination for this supply is surface wash from manured fields at times of rainfall. There is also the ever present possibility for incidental, accidental, or wilful contamination due to chance visitors upon the watershed. The inadequacy of this supply while partly due to the small watershed area available, is also due to the inadequate development of the stream and the lack of sufficient storage. The spring supplies contribute such a small amount of water to the supply that they can probably be ignored. However, there is some possibility for contamination due to surface wash from pasture land in which one set is located.

The well from which the auxiliary supply is obtained is located about 50 feet from the main highway running south from the village and about 500 feet from the west bank of the Susquehanna river. The nearest house is located about 200 feet distant at a higher elevation than the ground in the vicinity of the well. Within a radius of one-quarter of a mile of this well the population may be estimated at about 500 per square mile. The surface watershed area tributary to this well may be estimated at about 0.5 square miles with a population of 80 per square mile. At times of floods and ice jams in the river the area in the vicinity of the wells becomes flooded, and there have been times when the depth of water at the pumping station has been known to reach three feet. Such conditions occur, however, at times when there is an adequate supply from the upland source and when the well is not in operation. In the vicinity of the well the land is used for agricultural purposes. The well is located just outside the pumping station underneath a dilapidated shed. There is consequently a possibility of contamination of the soil, in the vicinity of the well. Neatness around a well, while not necessarily insuring adequate sanitary protection, renders pollution of the surrounding ground less liable to occur. Furthermore, there has been no special precaution taken with this well to prevent leakage of surface water down along the outside of the casing.

At the time of the inspection samples of water were collected from the well and also from the upland supply. The results of the analyses of these samples, together with others made in the past by the Division of Laboratories and Research, will be found in the appended table.

With the exception of the samples taken at the time of the inspection, it is impossible to state definitely whether the past analyses represent the upland supply unmixed with well water or not. It would appear, however, from the analytical results that the samples dated July 27, 1911, and April 13, 1911, were the well water, while the other samples were unmixed upland supply.

The recent analyses show that the surface supply is comparatively clear, colorless, and very soft. The amount of unoxidized nitrogenous organic matter present in this supply is comparatively low, although the chlorine content is approximately two or three times normal for this locality. On the other hand, the well supply, although clear and colorless, is very hard and, while containing very small amounts of unstable nitrogenous organic

matter, is rather high in oxidized nitrogen, as shown by the figures for nitrates. The chlorine content is ten to sixteen times the normal. These results indicate that the well water is derived from a source receiving at times more or less organic contamination, which in its passage through the soil becomes comparatively well oxidized and inactive. The original source of this oxidized organic matter is probably the fertilizer placed upon the cultivated fields in the vicinity and also the wastes of human and animal life existing upon the area tributary to the well.

On the whole, the bacterial counts are moderate, and fecal organisms of the B. coli type occur only occasionally in samples as large as 10 c. c. Although the bacteriological results of the analysis of the well water are satisfactory, the evidence, indicated by the chemical results, shows that this supply is derived from a source receiving organic pollution and renders it impossible to state that such satisfactory bacterial results will be obtained at all times and under varying draft on the well and different hydraulic conditions of the ground water. The occurrence of B. coli in the surface water is probably due to surface runoff from cultivated fields, and it is probably of animal rather than human origin.

The unsatisfactory results of the analyses made in July, 1911, are due to the fact that at that time a considerable growth of algæ occurred in the reservoir. At the time of the inspection the upland stream was very low, containing hardly sufficient amount to allow the collection of the samples and the results obtained can hardly be considered fully representative from a bacterial standpoint.

In view of the above facts the following conclusions may be drawn:

1. That the upland supply for the village of Windsor, although inadequate in quantity, is practically free from permanent sources of human contamination, but is subject to surface wash from pasture lands and manured fields.

2. That the spring supply as developed at present is open to contamination by surface wash from pasture lands, although the possibility of this contamination reaching the village supply is prevented by the clogging up of the connecting pipes.

3. That the well supply was of a satisfactory bacterial quality at the time of the inspection, although the chemical results show that this water has received at some time in the past considerable organic contamination of animal or human origin which, however, has become well purified by passage through the soil.

4. That the storage of ground waters in an open reservoir exposed to sunlight renders the growth of algæ very probable and, although such growths may not injuriously affect the health of the community, they depreciate markedly the esthetic quality of the water through the production of disagreeable tastes and odors.

I would therefore recommend:

1. That steps be taken to maintain the watershed of the upland supply in as satisfactory a sanitary condition as possible and, if any difficulty be experienced in controlling this watershed, that the village authorities apply to this Department for the enactment of rules and regulations for the sanitary protection of their water supply.

2. That, on account of the inadequate method for the development of this upland supply, steps be considered for its more careful conservation.

3. That the auxiliary springs be either more adequately protected from surface wash or else abandoned entirely.

4. That the immediate surroundings of the well be improved by:

(a) Placing the premises upon which the well and pumping station are located in a neat condition;

(b) Preventing all cultivation of land within 100 feet of the well;

(c) Fencing off the area surrounding the well in order to prevent trespassing in its vicinity;

(d) Providing all privies which may be located within a radius of 300 feet of the well with watertight removable containers, the

contents of which should be disposed of in a sanitary manner at some remote place.

5. That provision should be made against leakage of surface water down along the well casing by surrounding the casing with a concrete collar.

6. That in case of the recurrence of algæ trouble in the reservoir the reservoir be emptied and thoroughly cleaned.

Respectfully submitted,

THEODORE HORTON,
Chief Engineer

ALBANY, N. Y., *July* 22, 1915

RESULTS OF WATER ANALYSES

Abbreviations used to describe odors of water: 0, none; 1, very faint; 2, faint; 3, distinct; 4, decided; 5, strong; 6, very strong; a, aromatic; d, disagreeable; e, earthy; f, fishy; g, grassy; m, musty; v, vegetable

Municipality	County	Source of sample	Date of collection	Physical				Chemical (Parts Per Million)											Bacteriological			
						Odor		Solids			Nitrogen as—						Hardness			B. Coli Type + = present — = absent		
				Color	Turbidity	Cold	Hot	Total	Loss on ignition	Mineral residue	Free ammonia	Albuminoid ammonia	Nitrites	Nitrates	Oxygen consumed	Chlorine	Total	Alkalinity	Bacteria per c.c.: gelatin 20°, 48 hours	10 c.c.	1 c.c.	1-10 c.c.
Windsor	Broome	Tap, public supply	1/16/11	5	5	....	....	24	9	16	.006	.034	.001	0.10	0.70	0.75	11.1	9.0	10	—	—	—
Windsor	Broome	Tap, public supply	3/31/11	10	5	....	....	32	12	20	.008	.028	.001	0.05	0.40	1.00	11.1	6.0	325	—	—	—
Windsor	Broome	Reservoir, public supply	7/27/11	43	20	2 v.	2 v.	100	40	60	.022	.356	.100	1.60	8.00	6.25	48.6	38.0	2,500	+	+	—
Windsor	Broome	Tap, public supply	1/30/12	Tr.	Cl.	....	....	38	7	31	.026	.046	Tr.	0.05	0.40	1.00	24.7	21.0	30	—	—	—
Windsor	Broome	Tap, public supply	4/13/12	10	Cl.	....	....	65	28	37	.002	.068	Tr.	2.40	0.50	5.25	33.8	19.0	20	—	—	—
Windsor	Broome	Tap, public supply	10/11/12	5	Cl.	....	....	59	19	40	.002	.034	Tr.	0.04	2.20	1.25	39.0	14.0	70	+	—	—
Windsor	Broome	Tap, public supply	12/ 6/12	Tr.	Cl.	....	....	32	7	25	.010	.016	Tr.	0.30	0.50	1.00	18.2	10.0	40	—	—	—
Windsor	Broome	Tap, public supply	2/ 7/13	Tr.	Tr.	....	....	25	....	....	.090	.016	Tr.	0.08	0.40	1.00	12.7	7.0	10	—	—	—
Windsor	Broome	Tap, public supply	3/18/13	Tr.	Cl.	....	....	28	....	....	.008	.010	Tr.	0.14	0.50	0.75	12.7	6.0	10	—	—	—
Windsor	Broome	Tap, public supply	4/22/13	Tr.	Cl.	....	....	42	....	....	.020	.046	Tr.	0.04	1.00	0.50	14.3	1.0	170	+	—	—
Windsor	Broome	Tap, public supply	6/ 3/13	3	2	....	....	28	....	....	Tr.	.010	Tr.	0.02	1.40	0.50	15.6	9.0	170	—	—	—
Windsor	Broome	Tap, public supply	3/30/14	Tr.	Tr.	1 v.	1 v.	26	8	18	.008	.028	Tr.	0.12	0.86	0.75	12.7	8.0	375	2+1—	0+3—	0+3—
Windsor	Broome	Tap, public supply	6/29/15	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	50	0+3—	0+3—	0+3—
Windsor	Broome	Well supply, tap at pump	6/29/15	Tr.	Cl.	1 v.	1 v.	145	70	75	.008	.010	Tr.	2.00	0.50	8.25	50.0	29.0	10	0+3—	0+3—	0+3—
Windsor	Broome	Inlet, surface supply	6/29/15	Tr.	Cl.	1 a.	1 a.	121	37	84	.012	.040	.001	Tr.	1.20	1.00	39.0	35.0	250	3+0—	1+2—	0+3—

WURTSBORO

HERMANN M. BIGGS, M. D., *State Commissioner of Health:*

An investigation of the public water supply of the village of Wurtsboro, Sullivan county, was made on July 29 and 30, 1915, by Mr. E. S. Chase, assistant engineer in this Department, accompanied and aided by Dr. S. B. Schliemacher, health officer.

Wurtsboro is an incorporated village located near the southeastern boundary of Sullivan county on the Monticello branch of the N. Y. O. & W. R. R. The village has no industries and is largely a farming center.

The water supply is derived from a small stream leading from Mastens lake. A reservoir is located on this stream about one mile northwest of the village and about 3 miles from the lake. The waterworks were designed by Nicholas Contyne and constructed under his direction in 1898. The water works are owned and operated by the municipality of which Mr. Jos. E. Holmes is president. Practically the entire population of the village is supplied by the water although the average daily consumption is unknown. There are approximately two miles of water mains ranging in size from 4 inches to 6 inches in diameter and 100 service taps of which none are metered. The water is distributed by gravity with an available pressure of 120 lbs. per square inch.

The reservoir, formed by a masonry wall, is approximately 50 by 200 feet in plan with a maximum depth of 10 feet in the center and an average depth of 5 feet; its capacity is estimated at 600,000 gallons. The intake from the brook consists of a few hundred feet of 12-inch tile. The intake from the reservoir to the village mains is located in the reservoir at a maximum depth, the end being covered with a strainer. The reservoir is cleaned every spring and fall and the water mains are flushed every month or two in summer.

The watershed above the intake consists of a long narrow valley with steep side slopes. Immediately above the intake the hills are well wooded, but near the head of the stream and in the vicinity of Mastens lake the valley widens and the slopes become more moderate and consist of partly cleared land. There are about 22 houses upon the watershed adjacent to the brook and approximately 15 summer cottages on the watershed tributary to Mastens lake. With the exception of one house about one mile above the intake these houses are fairly distant from the stream. At Mastens lake several additional cottages are being constructed. This lake is a popular summer resort and during the summer two or three hundred people may be located in its vicinity, who use it for boating, bathing and fishing.

The natural outlet of this lake has been diverted so that the water flows into the stream from which the water supply is obtained. The most serious condition found on the watershed adjacent to this stream is a labor camp located about ½ mile above the intake and about 100 feet from the edge of the edge of the bank of the brook. This labor camp consists of an old barn which has been turned into temporary quarters for 35 or 40 Italian laborers, working on the State road which is being constructed along the southern bank of the stream. As far as could be learned no permit had been issued for this labor camp and its location is a serious menace to the water supply of Wurtsboro. This matter was however, taken up with the health officer immediately following the inspection. No toilet was provided and pollution of the ground by fecal matter was noticed.

At the time of the inspection samples were collected from Mastens lake, at the outlet of the lake, from the inlet to the reservoir and from a tap in the village. The result of the analyses of these samples together with others made in the past by the Division of Laboratories and Research will be found in the appended table.

These analyses show a soft water somewhat colored and at times turbid. The figures for decomposing and and decomposable organic matter are consistent with the conditions upon the watershed. The bacterial counts are

usually high even for surface supply and at times excessive, while organisms of the B. coli type are always present in 10 c.c., frequently in 1 c.c. and occasionally in 1/10 c.c. The occurrence of these organisms show clearly the presence of active contamination of animal or human origin.

In view of the above facts the following conclusions may be drawn:

1. That the public water supply of Wurtsboro is open to serious contamination of human origin due to the presence of numerous habitations upon its watershed, to the use of Mastens lake for boating, bathing and other pleasure purposes and, temporarily, to the location of the labor camp a short distance above the reservoir intake.

2. That, in addition to permanent sources of contamination there are the ever present possibilities of contamination of an accidental or wilful nature by transient visitors upon the watershed.

3. That the location of the reservoir on this stream was particularly unfortunate and ill-advised in view of the fact that another stream, the natural outlet of Mastens lake, is only ½ mile to the north which is apparently available for water supply and which flows through a practically uninhabited watershed.

I would therefore recommend:

1. That the village authorities make regular and frequent inspections of the watershed tributary to their supply in order to detect and abate any insanitary conditions which may be found to exist thereon.

2. That in case the village experiences any difficulty in abating insanitary conditions upon the watershed it apply to this Department for the enactment of rules and regulations for the sanitary protection of the supply.

3. That, if it is found impracticable to protect their present supply along the lines recommended above, the village should secure a new supply of unquestionable quality or else subject their present supply to some proper method of purification.

Respectfully submitted,

THEODORE HORTON,
Chief Engineer

ALBANY, N. Y., *September* 16, 1915

RESULTS OF WATER ANALYSES

Abbreviations used to describe odors of water: 0, none; 1, very faint; 2, faint; 3, distinct; 4, decided; 5, strong; 6, very strong; a, aromatic; d, disagreeable; e, earthy; f, fishy; g, grassy; m, musty; v, vegetable

Municipality	County	Source of sample	Date of collection	Physical		Odor		Chemical (Parts per Million): Solids			Nitrogen as—				Oxygen consumed	Chlorine	Hardness		Bacteriological	B. Coli Type (+ = present, − = absent)		
				Color	Turbidity	Cold	Hot	Total	Loss on ignition	Mineral residue	Free ammonia	Albuminoid ammonia	Nitrites	Nitrates			Total	Alkalinity	Bacteria per c.c.; gelatin 20°, 48 hours	10 c.c.	1 c.c.	1-10 c.c.
Wurtzboro	Sullivan	Tap, public supply	1/16/11	Tr.	2	....	....	29	....	19	.016	.084	.003	0.10	2.25	1.00	12.7	12.0	1,400	+	+	+
Wurtzboro	Sullivan	Tap, public supply	2/17/11	2	Tr.	....	....	40	....	23	.024	.032	.001	0.10	1.00	2.00	22.1	20.0	40	+	−	−
Wurtzboro	Sullivan	Tap, public supply	5/17/11	10	1	....	....	41	....	30	.012	.038	.001	0.10	1.60	1.25	22.1	15.0	450	+	−	−
Wurtzboro	Sullivan	Tap, public supbly	10/28/11	10	5	....	....	28	....	17	.004	.040	.001	Tr.	1.90	1.62	14.3	8.0	180	+	+	+
Wurtzboro	Sullivan	Tap, public supply	1/27/12	Tr.	Tr.	....	....	44	21	23	.022	.062	.001	0.14	1.10	1.25	18.2	10.0	150	+	−	−
Wurtzboro	Sullivan	Tap, public supply	10/ 9/12	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	400	+	−	−
Wurtzboro	Sullivan	Tap, public supply	11/13/12	8	Tr.	....	....	23	4	19	.020	.060	.001	0.04	2.00	0.75	18.2	9.0	1,500	+	−	−
Wurtzboro	Sullivan	Tap, public supply	1/ 1/13	10	5	....	....	65	....	....	.012	.042	Tr.	0.04	1.70	1.25	10.0	1.7	325	+	−	−
Wurtzboro	Sullivan	Tap, public supply	2/ 5/13	Tr.	2	....	....	20	....	....	.010	.050	Tr.	0.06	1.50	1.00	6.0	1.5	275	+	+	−
Wurtzboro	Sullivan	Tap, public supply	3/14/13	10	3	....	....	34	....	....	.014	.052	Tr.	0.04	1.30	1.00	8.0	1.3	350	−	−	−
Wurtzboro	Sullivan	Tap, public supply	4/17/13	10	Tr.	....	....	28	....	....	.012	.036	Tr.	0.04	1.50	0.87	6.0	1.5	240	+	−	−
Wurtzboro	Sullvian	Tab, public supply	5/29/13	8	Tr.	....	....	38	....	....	.010	.030	Tr.	0.04	1.70	0.37	11.0	1.7	375	+	−	−
Wurtzboro	Sullivan	Tap, public supply	7/10/13	7	2	....	....	46	....	....	.004	.038	Tr.	0.04	1.10	1.00	20.0	1.1	......	+	−	−
Wurtzboro	Sullivan	Tap, public supply	7/30/15	3	Tr.	2 e.	2 e.	81	10	71	.008	.030	.004	0.20	2.20	1.75	27.3	16.0	16,500	3+0−	2+1−	1+2−
Wurtzboro	Sullivan	Mastens lake	7/30/15	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	90	3+0−	1+2−	0+3−
Wurtzboro	Sullivan	Outlet, Mastens lake	7/30/15	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	1,400	3+0−	3+0−	2+1−
Wurtzboro	Sullivan	Inlet to reservoir	7/30/15	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	36,000	3+0−	0+3−	0+3−

WYOMING

HERMANN M. BIGGS, M.D., *State Commissioner of Health:*

An investigation of the public water supply of the village of Wyoming was made on August 11, 1915, by Mr. M. F. Sanborn, assistant engineer. The inspector was assisted at the time of the inspection by Dr. H. H. Bradley, health officer of the town of Middlebury; Mr. S. Hayden, president of the water company, and Mr. Charles Keith, secretary of the company.

Wyoming is an unincorporated village located in the town of Middlebury in the northeastern part of Wyoming county. It is about forty miles east of Buffalo and in the valley of Oatka creek, a tributary of Genesee river. It is on the Buffalo, Rochester and Pittsburg R. R. The population at the time of the inspection was estimated at about 500.

The public water supply is furnished by the Wyoming Water Works Company and the water is used chiefly for domestic purposes. No fire protection is provided in the village and the supply is insufficient during a large part of the year. The waterworks were designed and constructed by the company in 1884.

The water is obtained from about eight springs from one-half mile to one mile west of the village. The water from these springs drains naturally to Oatka creek. From these springs the water flows either directly to a reservoir or to the distributing system. About 300, or 60 per cent. of the population, are served by this supply. No figures of the daily water consumption could be obtained since no record is kept and no meters are installed. There are nearly two miles of water mains varying from three-quarters of an inch to two inches in size. Of the 150 houses in the village, 90 are served by this supply. The average pressure in the village when the reservoir is full of water is about 40 pounds, although at the time of the inspection the reservoir was empty and water could not be obtained at many of the houses except from taps in the cellars. It was stated by residents of the village that the supply is insufficient nearly all day and there is no water for domestic use or flushing of closets. This produces very insanitary conditions in the houses, since the toilets sometimes remain unflushed all day.

There is no sewer or method of sewage disposal in the village except local cesspools, septic tanks and privies.

The springs are located about one-half to one mile west of the village, some of them being in an open field draining the sand and gravel strata which lies above hardpan, while the others are located on the side of a ravine and collect the water as it issues from the rocks. Two of the springs are enclosed by stone masonry walls aboue five feet in diameter and five feet high. These springs are covered with a wooden roof. Two other springs are protected by stone walls three feet in diameter and 3 feet high. The tops of these springs are covered by a large flat stone and about two feet of soil in order that the cultivation of the fields may be carried on. Two other springs are protected only by barrels which are covered and another spring by a 2-foot diameter tile pipe. Another spring is at the south side of the reservoir and the waters from this spring issue directly into the reservoir. The water from all the springs except the spring at the reservoir and one other spring flows through a ¾-inch pipe to the 2-inch main pipe leading from the reservoir to the village. At the reservoir a 2-inch branch leads from the main to the reservoir in order that the surplus water may overflow at the reservoir.

The reservoir is located on the side of a ravine nearly one-half mile west of the village. This reservoir is of stone masonry sides, timber roof and the bottom is of earth. It is 10 by 20 feet in plan and 7½ feet deep. The capacity of the reservoir is about 11,250 gallons. At the time of the inspection this reservoir was empty, although previous to the inspection considerable rain had fallen. The reservoir is cleaned about every two years, although the water mains have never been cleaned and are probably clogged to a considerable extent by sediment or rust.

The surface area tributary to the springs is comparatively small, although the underground area from which they may draw water is probably about one square mile. There are no houses or buildings of any sort on the watershed. The first four springs mentioned are in cultivated land on a slight slope, the bottom of the springs being at the surface of the hardpan. The other springs are nearer the reservoir and receive the water flowing from the shale or slate.

At the time of the inspection of this supply a sample of the water was collected from a tap in the village and the analysis of this sample together with the analyses made in the past by the Division of Laboratories and Research will be found in the appended table. These analyses show a water slightly colored, occasionally turbid and very hard. The figures for organic matter are moderately high for a ground water supply. The figures for nitrates indicate the presence of past organic contamination which has been well oxidized in passing through the soil. The bacterial counts are also comparatively high and the presence of fecal organisms of the B-coli type in samples as small as 1 c. c. indicate active contamination of animal or human origin. From an examination of the sanitary conditions in the neighborhood of the springs, it appears very probable that the contamination as evidenced by the analytical results is brought about by the cultivation of the land in the vicinity of the springs rather than contamination by human excreta.

As a result of this investigation and of the analyses the following conclusions may be drawn:

1. That the water supply of Wyoming as developed at present is totally inadequate in quantity and somewhat unsatisfactory in quality.
2. That the inadequacy of the supply is due to
   (a) Insufficient size of water mains from springs and reservoir to village.
   (b) Leakage from the reservoir through the earth bottom.
3. That the insufficiency of the supply causes decidedly unpleasant and insanitary conditions in the houses due to lack of water for flushing water closets.
4. That the sanitary quality of the supply is depreciated by the use of the land in the vicinity of the springs for cultivation.
5. That from a general inspection of the vicinity of the springs it would appear that there is opportunity for further development of the same and the securing of a larger amount of water. This, however, could not be fully verified at the inspection and a more detailed investigation than is possible for this Division, should be made before additional springs are developed.

In view of the above conclusions I would recommend that the water company take immediate steps to increase the amount and improve the quality of the water furnished by them as follows:

1. Develop the present supply to a further extent or secure additional water from some other satisfactory source.
2. Protect the springs more carefully from contamination and surface water by the construction of concrete basins around each spring, the basins to extend one foot above the surface of the ground and to have a tight cover which can be kept locked.
3. Provide a water tight bottom for the reservoir.
4. Install a larger main from the springs and reservoir to the village.
5. Flush the water mains at sufficiently frequent intervals to keep them free from deposits.

Respectfully submitted,

THEODORE HORTON,
Chief Engineer

ALBANY, N. Y., *September* 17, 1915

RESULTS OF WATER ANALYSES

Abbreviations used to describe odors of water: 0, none; 1, very faint; 2, faint; 3, distinct; 4, decided; 5, strong; 6, very strong; a, aromatic; d, disagreeable; e, earthy; f, fishy; g, grassy; m, musty; v, vegetable

Municipality	County	Source of sample	Date of collection	Physical				Chemical (Parts per Million)											Bacteriological			
						Odor		Solids			Nitrogen as—						Hardness			B. Coli Type + = present — = absent		
				Color	Turbidity	Cold	Hot	Total	Loss on ignition	Mineral residue	Free ammonia	Albuminoid ammonia	Nitrites	Nitrates	Oxygen consumed	Chlorine	Total	Alkalinity	Bacteria per c.c.: gelatin 20°, 48 hours	10 c.c.	1 c.c.	1-10 c.c.
Wyoming	Wyoming	Tap, public supply	3/17/10	3	Cl.	....	....	212	....	177	.002	.002	.001	1.00	0.50	0.50	162.8	143.0	100	—	—	—
Wyoming	Wyoming	Tap, public supply	2/25/11	Tr.	Cl.	....	....	221	....	178	.006	.018	.001	1.00	0.80	2.00	162.8	163.0	375	+	—	—
Wyoming	Wyoming	Tap, public supply	9/27/11	10	3	....	....	298	....	278	.010	.042	.001	0.60	0.20	2.00	250.0	223.0	500	+	+	—
Wyoming	Wyoming	Tap, public supply	11/24/11	Tr.	Cl.	....	....	335	....	287	.030	.030	.002	1.80	0.20	2.50	250.0	214.0	60	+	—	—
Wyoming	Wyoming	Tap, public supply	1/17/12	5	Cl.	....	....	259	....	230	.024	.032	Tr.	4.40	0.40	1.75	195.0	181.0	10	—	—	—
Wyoming	Wyoming	Tap, public supply	3/11/12	Tr.	Cl.	....	....	254	....	198	.016	.047	Tr.	2.80	0.10	1.75	185.8	182.0	30	—	—	—
Wyoming	Wyoming	Tap, public supply	9/28/12	Tr.	Cl.	....	....	315	....	284	.002	.004	.001	1.20	0.60	2.25	260.0	221.0	800	+	+	—
Wyoming	Wyoming	Tap, public supply	11/20/12	5	3	....	....	291	....	245	.012	.034	Tr.	1.40	0.80	2.12	228.5	214.0	350	+	+	—
Wyoming	Wyoming	Tap, public supply	1/11/13	Tr.	Cl.	....	....	257	....	....	.012	.048	.004	3.40	0.30	2.00	195.0	178.0	120	+	—	—
Wyoming	Wyoming	Tap, public supply	3/ 7/13	2	Tr.	....	....	297	....	....	.010	.018	Tr.	5.00	0.30	3.50	174.2	151.0	300	—	—	—
Wyoming	Wyoming	Tap, public supply	4/18/13	Tr.	Tr.	....	....	248	....	....	.010	.006	Tr.	7.00	0.40	2.75	......	148.0	200	—	—	—
Wyoming	Wyoming	Tap, public supply	6/ 6/13	Tr.	2	....	....	272	....	....	.004	.012	.001	5.00	0.40	2.25	201.5	177.0	700	—	—	—
Wyoming	Wyoming	Tap, public supply	8/11/15	Tr.	Tr.	1 a.	1 a.	332	50	282	.002	.014	.001	3.00	0.50	3.00	228.5	207.0	475	3+0—	3+0—	1+2—

YONKERS

HERMANN M. BIGGS, M.D., *State Commissioner of Health:*

A reinspection of the public water supply of the city of Yonkers was made on October 28, 29, and 30, 1914, by Dr. L. W. Hubbard, sanitary supervisor of district "T." A previous investigation of this supply was made by the Engineering Division in 1910 in connection with a study of the undue prevalence of typhoid fever at that time. The report of this earlier investigation will be found on page 616 of the thirty-first annual report of the Department. The following facts are based largely upon information furnished by Dr. Hubbard.

The public water supply of Yonkers is derived from two main sources; one from the Saw Mill river and the other from the Grassy Sprain reservoir, which impounds the waters from the Grassy Sprain and Sprain rivers. The supply derived from the Saw Mill river is subjected to slow sand filtration and subsequent sterilization with hypochlorite of lime. The present population of Yonkers is approximately 95,000, and the daily water consumption is 9,000,000 gallons. The water works are owned and operated by the city.

The filtration plant near the Saw Mill river consists of four units of slow sand filters, and two additional units, each three-quarters of an acre in area, were in the process of construction at the time of the reinspection. The unsatisfactory operation of the filters, as mentioned in the 1910 report, has been corrected; that is, the rate measuring and loss of head gauges are in use and the method of application of the hypochlorite of lime has been improved. Since the earlier report a substantial building, containing a hypochlorite tank with automatic valves, has been erected and the hypochlorite solution is applied to the water in definite strength and at a uniform rate in proportion to the amount of water pumped. Furthermore, it is now applied to water after filtration instead of before, as was formerly the case. The amount of hypochlorite added amounts to about twelve pounds per million gallons, or at the rate of about .5 parts per million by weight of available chlorine.

For the past three years the greater proportion of the water supply has been taken from the Saw Mill river, except during the summer, when the water which is collected during the winter and spring in the Grassy Sprain reservoir is drawn upon. At the time of the reinspection about 6,000,000 gallons of water were being taken from the Saw Mill river daily. During the winter the Grassy Sprain reservoir is shut off and the water stored in it allowed to accumulate for use as a reserve supply during the dry weather of summer.

The watershed of the Sprain and Grassy Sprain rivers is 4.4 square miles in area, with a population of approximately 170, or about 40 per square mile. The majority of houses on this watershed are well distant from the reservoir and its tributary watercourses. Furthermore, the area is carefully inspected in order to prevent as far as possible all contamination. There is, however, the always present possibility of accidental or wilful contamination from the resident population and from chance visitors on the watershed.

The Saw Mill river above the waterworks intake has a watershed area of about twenty-four square miles. There are numerous hamlets and many dwellings scattered over this area, and the total population may be estimated at 5,000, or approximately 200 per square mile. About 2,500 of this population are inmates of the charitable institutions and hospitals located upon the watershed. These institutions are provided with sewage disposal plants, the effluents of which discharge into the river or its tributaries. In some cases these disposal plants are very inefficiently and carelessly operated. Investigations have been made recently by this Department of the methods of operation and efficiency of three of these disposal plants and the local authorities in charge of these plants have been required to make such improvements as were found necessary. The remaining disposal plants upon this watershed will be inspected and improvements required as soon as possible.

The watersheds of both sources of supply are protected by rules and regulations enacted by this Department in 1904. The growth of population upon the Saw Mill river watershed has rendered the enforcement of these rules somewhat difficult and the abatement of violations a somewhat costly procedure. Consequently there are many violations of the rules which have not been abated, some of these violations having existed for many years. The city has taken little action to abate these violations except to serve notices upon various individuals, to which no attention has been paid, and the city has not instituted legal proceedings to enforce compliance with the rules and regulations.

At the time of the inspection in 1910, it was found there were 91 violations existing, and there are probably fully as many at the present time. The greater proportion of these violations consists of privies and cesspools situated on the edge of the Saw Mill river and its tributaries. By percolation through the soil, sewage may reach the stream even where there is no evidence of direct discharge into the stream. There is also evidence of drainage from barn yards, poultry yards, house drains, etc., in very many places. The most serious conditions exist at several points where there is direct and positive pollution of the stream by sewage.

At the Mount Hope station, where the Hudson Heights Realty Company of Hastings has built several houses and constructed two cesspools, there is a good-sized stream of sewage flowing from one of these cesspools directly into the river. About one-sixth of a mile above this point a sewer from a private house discharges directly into the river. This condition is said to have existed for twenty years.

At the village of Ardsley conditions are very bad, principally along the tributary brook which runs parallel to Ashford avenue, and upon which are located several houses with privies close to the bank. In September, 1914, a case of typhoid fever is known to have stayed for three days in one of the houses bordering on this small stream. The potential danger of such condition is clearly apparent.

Another serious condition occurs at the sewage disposal plant of the Westchester county almshouse at Eastview. The plant is deteriorated so that it is not even as satisfactory as at the time of the previous report. There has been no increase in the size of the filter beds, and the population of the institution has increased to five or six hundred, and in winter time runs up to nearly seven hundred. Of this population some 50 or 60 are tubercular patients. Sewage is discharged on the filter beds through large pipes extending about one foot from the edge of the filter beds, there being no method of applying the sewage uniformly over the surface of the beds. The filter beds are constructed of coarse gravel and are not covered with sand. The effluent from the filters is discharged in a putrescible state directly into the stream, causing a marked discoloration of the river water.

At Thornwood a privy belonging to a saloon is built about three feet from the edge of the river on a sloping bank, and it is evident that material from this privy is washed directly into the stream. In the village of Pleasantville there are three privies very close to the brook tributary to the river which undoubtedly bring about pollution of the stream. At Chappaqua there are some twenty serious conditions, consisting of privies, cesspools and overflow pipes along the edge of a small stream tributary to the river. The disposal plant for the Children's Aid Society of New York City was examined and apparently was doing efficient work, producing a clear and odorless effluent.

Following an investigation and report by Hazen and Whipple, consulting engineers, surveys have been made and plans prepared by the city authorities for the collection of the water from the Saw Mill river at Woodland Lake, situated about three-fourths of a mile above Ardsley. From this intake the water will be carried by pipe line to the Grassy Sprain reservoir, the capacity of which will be increased to 900,000,000 gallons by increasing the height of the dam. All of the water will then be brought to the filtration plant and subjected to filtration and sterilization. After this change the intake will be above the most serious of the sources of pollution with the exception of the county almshouse.

The report of the previous investigation in 1910 pointed out clearly the decidedly unsatisfactory and dangerous conditions upon the watershed of the Saw Mill river. Furthermore, it was shown that the filtration plant was operating unsatisfactorily, due to the failure to determine and control the rate of filtration by rate measuring and loss of head gauges, and also due to the fact that the filters were not operating uniformly. At that time the hypochlorite solution was added to the raw water before filtration in a very crude, inefficient, and fundamentally wrong manner. It was, therefore, recommended that conditions upon the watershed be improved at once and changes and improvements be made in the methods of operating the filters and applying the hypochlorite solution.

From the report of Dr. Hubbard, it appears that the operation of the filters has been improved along the lines recommended, although few, if any, improvements have been made in the conditions upon the Saw Mill river watershed. The change of location of the intake, together with the opportunity for sedimentation in the Grassy Sprain reservoir, will be a change for the better.

On November 9, 1914, Dr. Hubbard collected samples of raw and filtered water, analyses of which, together with others made in the past by the Division of Laboratories and Research, will be found in the appended table.

These analyses show the grossly polluted character of the raw water, the total number of bacteria being high and organisms of the B. coli type present in quantities as small as 0.1 c. c., in a majority of the samples. Analyses of the filtered water show comparatively satisfactory results, although in one or two samples B. coli were found in 10 c. c.

In view of the facts the following conclusions may be drawn:

1. That the recommendations of this Department relative to the improvements in the operation of the filtration plant and the methods of application of the hypochlorite of lime have been carried out, although as yet little if any attempt has been made to improve the sanitary conditions upon the Saw Mill river watershed.
2. That the location of the water works intake at Woodland Lake and the impounding of the river water in the Grassy Sprain reservoir will tend to produce a much better quality of raw water for the filters to treat.
3. That the inefficient operation of sewage disposal plants upon this watershed brings about a particularly serious and dangerous contamination of the Saw Mill river.

I would, therefore, recommend:

1. That the city of Yonkers take such steps as are found practicable to reduce to a minimum the sources of pollution upon the Saw Mill river watershed.
2. That the city authorities carry out as soon as possible the proposed improvements to their water supply system and continue to operate the filtration plant with care and efficiency.

Respectfully submitted,

THEODORE HORTON,
Chief Engineer

ALBANY, N. Y., *May* 21, 1915

RESULTS OF WATER ANALYSES

Abbreviations used to describe odors of water: 0, none; 1, very faint; 2, faint; 3, distinct; 4, decided; 5, strong; 6, very strong; a, aromatic; d, disagreeable; e, earthy; f, fishy; g, grassy; m, musty; v, vegetable

Municipality	County	Source of sample	Date of collection	Physical: Color	Physical: Turbidity	Physical: Odor: Cold	Physical: Odor: Hot	Chemical (Parts per Million): Solids: Total	Solids: Loss on ignition	Solids: Mineral residue	Nitrogen as: Free ammonia	Nitrogen as: Albuminoid ammonia	Nitrogen as: Nitrites	Nitrogen as: Nitrates	Oxygen consumed	Chlorine	Hardness: Total	Hardness: Alkalinity	Bacteriological: Bacteria per c.c. gelatin 20°, 48 hours	B. Coli Type (+ present, − absent): 10 c.c.	1 c.c.	1-10 c.c.
Yonkers	Westchester	Raw water, Saw Mill river	2/22/12	20	25			132	40	92	.210	.258	.007	0.90	3.90	6.50	64.3	52.0	......	+	+	+
Yonkers	Westchester	Filtered water	2/22/12	Tr.	Cl.			135	35	100	.098	.108	.002	1.08	2.50	7.00	75.7	64.0	40	−	−	−
Yonkers	Westchester	Raw water	3/26/12	20	5			125	22	103	.061	.138	.002	0.90	2.00	4.25	60.0	36.0	3,800	+	+	+
Yonkers	Westchester	Filtered water	3/26/12	5	Cl.			120	18	102	.014	.070	Tr.	1.20	1.00	5.75	77.1	50.0	10	−	−	−
Yonkers	Westchester	Grassy Sprain supply	5/6/12	15	Tr.			75	23	52	.036	.084	.002	0.26	2.70	4.25	33.8	21.0	30	+	−	−
Yonkers	Westchester	Raw water	8/29/12														......	......	1,500	+	+	−
Yonkers	Westchester	Filtered water	8/29/12	Tr.	Cl.			198	28	170	.004	.042	Tr.	0.68	1.90	8.50	117.2	104.0	10	+	−	−
Yonkers	Westchester	Grassy Sprain supply	8/29/12														......	......	100	+	−	−
Yonkers	Westchester	Raw water	10/16/12	20	Cl.			165	28	137	.012	.100	.003	0.30	2.60	10.20	114.2	114.0	600	+	+	−
Yonkers	Westchester	Filtered water	10/16/12	5	Cl.			165	28	137	.004	.028	Tr.	0.40	1.00	9.25	120.0	119.0	10	−	−	−
Yonkers	Westchester	Grassy Sprain supply	10/16/12	20	5			90	22	68	.030	.202	.001	0.06	3.60	4.00	50.0	45.0	240	+	−	−
Yonkers	Westchester	Raw water	12/19/12	25	3						.030	.112	.007	0.80	2.50	8.75	97.1	90.0	8,000	+	+	−
Yonkers	Westchester	Filtered water	12/19/12	10	Cl.			183	21	162	.020	.052	.001	0.80	2.00	9.00	120.0	84.0	10	−	−	−
Yonkers	Westchester	Raw water	1/22/13	20	10						.038	.094	.005	1.00	3.00	6.50	75.7	51.0	2,800	+	+	+
Yonkers	Westchester	Filtered water	1/22/13	10	Cl.			133			.014	.062	Tr.	1.10	2.30	7.00	81.4	33.0	20	−	−	−
Yonkers	Westchester	Raw water	2/26/13	15	16			151			.058	.130	.003	0.70	3.10	6.50	81.4	58.0	5,300	+	+	+
Yonkers	Westchester	Filtered water	2/26/13	Tr.	Cl.			137			.014	.048	.001	1.00	1.80	6.75	80.0	58.0	20	−	−	−
Yonkers	Westchester	Raw water	4/9/13	20	2			131			.020	.098	.003	0.70	2.70	5.87	82.9	62.0	800	+	+	−
Yonkers	Westchester	Filtered water	4/9/13	7	Tr.			125			.028	.090	Tr.	0.80	1.80	6.37	87.3	60.0	20	−	−	−
Yonkers	Westchester	Raw water	5/21/13	15	3			160			.030	.114	.005	0.50	2.40	5.75	95.7	93.0	500	+	+	−
Yonkers	Westchester	Filtered water	2/21/13	7	Cl.			159			.006	.032	Tr.	0.66	1.50	6.50	102.8	93.0	70	−	−	−
Yonkers	Westchester	Raw water	7/3/13	25	5			181			.390	.448	.015	0.18	2.90	7.50	120.0	119.0	5,100	+	+	−
Yonkers	Westchester	Filtered water	7/3/13	10	Cl.			173			.004	.052	.001	0.56	1.50	7.75	122.8	113.0	......	+	−	−
Yonkers	Westchester	Grassy Sprain supply	7/3/13	5	2			93			.180	.146	.005	0.06	2.90	4.25	47.1	41.0	160	+	−	−
Yonkers	Westchester	Raw water, Saw Mill river	10/9/14														......	......	1,600	3+0−	2+1−	1+2−
Yonkers	Westchester	Effluent, filter No. 1	10/9/14														......	......	25	0+3−	0+3−	0+3−
Yonkers	Westchester	Effluent, filter No. 3	10/9/14														......	......	70	1+2−	0+3−	0+3−
Yonkers	Westchester	Tap, mixed effluent after sterilization	10/9/14														......	......	45	0+3−	0+3−	0+3−

YORKTOWN HEIGHTS (New York State Training School for Boys)

Plans and specifications for a proposed water supply system for the New York State Training School for Boys at Yorktown Heights were submitted by Hon. Lewis F. Pilcher, State Architect, on November 25, 1914. The proposed water supply system consisted of six tubular wells near the southern shore of Mohansic lake, pumping station, force main and elevated water tower, distributing system, hydrants and house connections. These plans were approved by the Department on December 7, 1914, on condition that the wells be located at a point not less than 50 feet of the shore of the lake and above the level of the highway.

NOTE.— This matter was omitted from the 1914 report of this Department.

YOUNGSTOWN

HERMANN M. BIGGS, M.D., *State Commissioner of Health:*

An investigation of the public water supply of Youngstown was made by Mr. C. M. Baker, assistant engineer, on June 28, 1915.

Youngstown is an incorporated village of about 800 inhabitants, located near the mouth of the Niagara river, about eleven miles from Niagara Falls.

The supply is owned and operated by the village and is pumped from the Niagara river through a pressure mechanical filter to a standpipe, whence it is distributed by gravity through the mains to the consumers. The pumping plant is located in the village near the river. Practically all of the inhabitants are furnished with the water, but due to the fact that the quality of the water has been considered unsatisfactory private wells are depended upon for drinking and culinary purposes. There is a total of 140 service taps, none of which are metered. The water consumption is estimated at an average of 80,000 gallons per day with a maximum of 150,000 gallons daily in the month of September and a minimum of 40,000 gallons daily in the winter. The water pressure in the village ranges from 35 to 45 pounds, depending upon the elevation of the water in the standpipe.

The intake consists of an 8-inch pipe extending through shallow water for a distance of about 50 feet to a point just beyond a dock or crib. It was stated that the water at this point, which is just beyond a ledge or rock, is about 40 feet deep. The end of the pipe is 10 or 12 feet below the surface of the water and is unprotected by crib or other structure. The plant consists of a brick building in which are located the engines, pumps and filter. There are two Demming pumps, each having a capacity of 200 gallons per minute. They are driven by an electric motor of 25 horsepower or may be operated by means of two gasoline engines, each of 15 horsepower.

The filter is of the ordinary pressure mechanical type, 8 feet in diameter and 10 feet long. It was stated that the depth of sand in the filter is 32 inches. The surface area of the sand is about 78 square feet, which will give a rate of filtration equivalent to 161,000,000 gallons per acre per day when one pump is in operation, or twice this rate if both pumps are operated at one time, as would be necessary in case of fire. The filter is so connected with the pumps that it may be by-passed and the water pumped directly to the standpipe from the river and this is the practice in case of fire and also occasionally during fire drills.

The apparatus designed for applying alum to the water before it passes through the filter consists of a tight metal drum in which the dry alum may be placed and through which water can be passed from the pressure main into the suction line. The amount of alum used may be controlled by adjusting the flow of water through the alum tank. This apparatus, however,

has not operated satisfactorily and, in fact, no alum has been applied to the water for several years. The filter is washed with raw water by operating both pumps and shifting the valves so that the flow of water through the sand is reversed. The engineer in charge of the plant stated that until recently the filters had been washed once weekly but that a representative of the company which installed the filter informed him that he was washing the filter too often and since that time the filters have been washed about every two weeks. Pressure gauges are provided for determining the loss of head through the filter, but the engineer in charge stated that he had not been informed at what loss of head the filters should be washed. After being washed with unfiltered river water the filter is rinsed by filtered water from the standpipe, delivered through a two-inch pipe. None of the first filtrate is wasted after washing.

The standpipe, which is constructed of steel, is located in the center of the village. It is 100 feet high and has a capacity of 60,000 gallons.

The Niagara river receives the raw sewage from Buffalo, Tonawanda, North Tonawanda and Niagara Falls, located above the village of Youngstown. It is therefore an established fact that the water is very highly polluted and entirely unsatisfactory for domestic purposes without effective purification. This fact is borne out not only by analyses of the water but also by the excessive typhoid rate in cities using the unpurified water from this river.

As stated above, wells are depended upon throughout the village for drinking water and although no general investigation was made of the wells of the village, samples were collected from one located near the center of the village and which is used by a number of the inhabitants. This well is directly across the street from the standpipe, is about 30 feet deep and is protected from surface wash by a concrete platform provided with an iron pipe drain. The nearest privy is about 100 feet distant and in such a position that the ground water flow is probably toward the well from the privy. A hotel privy is located about 200 feet distant in the opposite direction. There are probably 25 houses within a radius of 500 feet of the well which would normally correspond to a population of about 125 people. The sewage from these places is in all cases disposed of by means of privies or cesspools. The soil is sand and clay with boulders and some rock formation.

Samples of water for chemical and bacteriological analyses were collected from the well and also from the filtered water of the village supply. A bacterial sample was also collected of the unfiltered river water. The results of these analyses, together with other previous analyses are recorded in the table appended hereto.

The results of the analyses of the Niagara river water bear out the previous statement that this water is badly polluted, the bacteriological content running as high as 32,500 per c. c. with the B. coli type present in all cases in quantities as small as 1/10 c. c. The results of the analyses of the filtered water show that the bacterial efficiency of the filter is very low, the bacterial content ranging from 350 to 26,000 with the B. coli type present in all but one or 94 per cent. of the 10 c. c. and 1 c. c. samples and in 60 per cent. of the 1/10 c.c. samples. While it is possible that the filter removes some of the bacteria, it is apparent that it does not render the water satisfactory for domestic purposes, and neither does the filter effectively remove turbidity.

In order to obtain the maximum efficiency of a mechanical filter it is necessary that alum or other coagulant be used, since the effectiveness of filtration depends upon the formation of a precipitate which entangles with it the particles of dirt and many of the bacteria. This precipitate, together with the entangled dirt and bacteria, is strained out by the filter sand and forms a mat on the surface and, to some extent, in the sand. The mat thus formed serves as an effective barrier to the passage of bacteria. The rate of operation of the filter is in excess of that which should be allowed.

The practice of by-passing the filter at the time of fire or in case of fire drills is objectionable.

The results of the analysis of the water taken from the well show very high nitrates and excessively high chlorine, which indicate that the well is

very badly polluted. The bacterial content is high and the B. coli type are present in 10 c. c. inoculations, which indicate that this pollution is becoming somewhat active. Although this particular well is unfortunately located, practically in the center of the village where the opportunity of pollution is excessive, it is quite probable that there are also other wells in the village which are subject to sufficient pollution to render them unsatisfactory for domestic purposes. In fact, it has been found by experience that wells located in the center of a dense population provided with insanitary methods of waste disposal as is the case in Youngstown, eventually become contaminated.

As a result of this investigation it is concluded:

1. That the raw water from the Niagara river is very badly polluted and unfit for domestic use without effective purification.

2. That the present filter plant is unsatisfactory and the method of its operation is very ineffective because:

(a) Alum or other coagulant is not used in connection with the filter, and the apparatus for applying the alum is not properly designed to effectively control the amount of alum used.

(b) The rate is comparatively high in view of the fact that there is no supplementary treatment.

(c) The method of washing the filter with raw water and failure to waste the first filtrate after washing is not in accordance with the best practice.

(d) The filter is by-passed in case of fire and fire drills.

3. That in regard to the well supplies:

(a) The well from which a sample of water was collected and analyzed is open to the possibility of contamination from nearby privies and other sources. Furthermore, the analysis indicates that the water was somewhat actively contaminated at the time of inspection.

(b) It is reasonable to assume that similar conditions exist in respect to other wells in the village and if not already occasionally contaminated they are apt to become so at almost any time.

It is evident from the above that the village should be provided with an adequate water supply of a safe and sanitary quality and I, therefore, beg to offer the following recommendations to be acted upon by the village authorities:

1. That steps be taken immediately to improve the present filter plant and its method of operation by,

(a) The design and installation of an apparatus for the satisfactory application of alum to the water before it passes upon the filter.

(b) Installing additional filters if no supplementary treatment is provided.

(c) Rearranging the pipe connections supplying the wash water for the filter so that the filtered water may be obtained from the standpipe for washing the filter, and wasting the first filtrate after washing.

(d) Preventing the discharge of untreated water directly onto the mains under any circumstances.

2. That, in view of the seriously contaminated condition of the Niagara river and of the somewhat unreliable results obtained from this type of filter, and also in view of the comparatively high rate at which the present filter must be operated, suitable apparatus be provided for the constant sterilization of the filtered water with liquid chlorine.

3. That as soon as the above improvements are carried out and it can be shown that satisfactory results are being obtained, the well supplies be abandoned. It also seems advisable that regular analyses of the water be made during the year to control the operation and determine the effectiveness of the plant and in view of the obvious lack of efficient operation of the filter plant as above pointed out, and to the

prime importance of this feature as affecting the safety of the water supply, it is suggested that the village follow out the plan which is now being quite generally adopted by the more progressive waterworks managements in the State of engaging the services of a competent consulting expert to make occasional visits to the plant during the year to study the local conditions and operation of the filters and give detailed advice as to the best methods to employ to improve the operation of the plant and maintain it at its highest possible efficiency.

Respectfully submitted,

THEODORE HORTON,

Chief Engineer

ALBANY, N. Y., *July* 27, 1915

RESULTS OF WATER ANALYSES

Abbreviations used to describe odors of water: 0, none; 1, very faint; 2, faint; 3, distinct; 4, decided; 5, strong; 6, very strong; a, aromatic; d, disagreeable; e, earthy; f, fishy; g, grassy; m, musty; v, vegetable

Municipality	County	Source of sample	Date of collection	Physical				Chemical (Parts per Million)											Bacteriological			
						Odor		Solids			Nitrogen as—						Hardness			B. Coli Type + = present — = absent		
				Color	Turbidity	Cold	Hot	Total	Loss on ignition	Mineral residue	Free ammonia	Albuminoid ammonia	Nitrites	Nitrates	Oxygen consumed	Chlorine	Total	Alkalinity	Bacteria per c.c.; gelatin 20°, 48 hours	10 c.c.	1 c.c.	1-10 c.c.
Youngstown	Niagara	Raw Niagara river water	3/14/11	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	32,500	+	+	+
Youngstown	Niagara	Raw Niagara river water	4/14/11	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	18,000	....	+	+
Youngstown	Niagara	Raw Niagara river water	6/28/15	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	2,500	+	+	+
Youngstown	Niagara	Filtered water	2/14/11	Tr.	3	....	....	147	39	108	.020	.080	.004	0.10	2.00	6.75	102.8	99.0	4,500	+	+	—
Youngstown	Niagara	Filtered water	4/14/11	5	Tr.	....	....	169	40	129	.008	.088	.001	0.10	0.90	6.25	57.1	55.0	350	—	—	—
Youngstown	Niagara	Filtered water	6/ 6/11	10	5	....	....	146	46	100	.012	.060	.002	0.04	1.40	7.25	94.3	90.0	10,500	+	+	....
Youngstown	Niagara	Filtered water	7/15/11	2	Tr.	....	....	145	25	120	.006	.058	.001	0.04	1.60	7.25	101.5	88.0	700	+	+	+
Youngstown	Niagara	Filtered water	12/6/11	15	10	....	....	146	18	128	.018	.064	.002	0.08	1.02	7.75	117.2	97.0	1,400	....	+	+
Youngstown	Niagara	Filtered water	4/23/12	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	13,500	+	+	+
Youngstown	Niagara	Filtered water	4/23/12	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	8,600	+	+	—
Youngstown	Niagara	Filtered water	4/20/12	15	15	....	....	137	31	106	.008	.074	.001	0.06	0.90	6.75	94.2	86.0	22,500	+	+	+
Youngstown	Niagara	Filtered water	9/20/12	5	Cl.	....	....	149	27	122	.002	.070	.001	0.04	1.30	8.25	120.0	90.0	55,000	+	+	+
Youngstown	Niagara	Filtered water	11/22/12	5	Tr.	....	....	139	18	121	.014	.090	Tr.	0.08	2.00	8.25	108.6	95.0	21,500	+	+	+
Youngstown	Niagara	Filtered water	1/ 9/13	10	10	....	....	156	....	....	.012	.072	.001	0.12	2.00	7.75	94.2	91.0	30,500	+	+	+
Youngstown	Niagara	Filtered water	2/27/13	8	Tr.	....	....	151	....	....	.014	.082	Tr.	0.08	1.10	8.00	102.8	92.0	1,600	+	+	—
Youngstown	Niagara	Filtered water	4/10/13	5	5	....	....	131	....	....	.014	.062	.001	0.10	1.60	7.25	94.3	84.0	9,700	+	+	—
Youngstown	Niagara	Filtered water	5/29/13	7	2	....	....	143	....	....	.010	.046	.001	0.06	0.90	7.75	100.0	90.0	26,000	+	+	+
Youngstown	Niagara	Filtered water	6/28/15	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	1,000	+	+	+
Youngstown	Niagara	Filtered water	6/28/15	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	1,100	+	+	+
Youngstown	Niagara	Filtered water	6/28/15	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	19,500	+	+	+
Youngstown	Niagara	Well in center of village	6/28/15	Tr.	Cl.	1 v.	1 v.	686	195	491	.002	.012	Tr	6,00	.80	42.00	335.5	328.0	2,000	+	—	—

In addition to the foregoing, inspections were made or advice given through correspondence relative to water supplies at the following municipalities:

Gouverneur
Gowanda
Heuvelton
Lewis
New York City
Niagara Falls
Oakfield
Oswego
Parksville
Tarrytown
Whitney's Point
Williamsville

PREPARATION OF RULES FOR THE PROTECTION OF PUBLIC WATER SUPPLIES

The preparation of rules and regulations for the sanitary protection of public water supplies is one of the important duties of the Engineering Division. The enactment of such rules and regulations is made by this Department under the provisions of the Public Health Law, upon request from local officials having supervision of the water works.

The Public Health Law prescribes a definite procedure for the enforcement of such rules and regulations, the carrying out of which is a duty resting largely upon the water works officials acting in conjunction with this Department and the local boards of health.

Eighty-three public water supplies in the State are now protected by rules and regulations. In each case these rules and regulations are prepared under careful inspection of the water supply and after local conditions and requirements are fully considered.

During the year 1915, there were before the Department for enactment or amendment, rules and regulations for the protection of the water supplies in the cases of the following municipalities: Arkport, Bovina Center, Cooperstown, Corinth, Cornell University, Haverstraw (amendments), Ilion, Liberty, Morris, New York City (Ashokan watershed), North Tarrytown and Sylvan Beach.

Of the above list rules and regulations were enacted for Arkport, Bovina Center, Morris, New York City (Ashokan watershed), North Tarrytown, Sylvan Beach and amendments for Haverstraw. In the cases of the other municipalities, rules and regulations have been fully prepared but this Department is awaiting other advices from the local authorities before final enactment.

Abstract of the New York State Public Health Law providing for the protection from contamination of the public water supplies throughout the State of New York. Chapter 45 of the Consolidated Laws (Public Health Law) as amended by Chapter 695 of the Laws of 1911.

"Section 70. Rules and regulations of Department. The State Department of Health may make rules and regulations for the protection from contamination of any or all public supplies of potable waters and their sources within the State, and the commissioner of water supply, gas and electricity of the city of New York may make such rules and regulations subject to the approval of the State Department of Health for the protection from contamination of any or all public supplies of potable waters and their sources within the state where the same constitutes part of the source of the public water supply of said city. If any such rule or regulation relates to a temporary source or act of contamination, any person violating such rule or regulation shall be liable to prosecution for misdemeanor for every such violation, and on conviction shall be punished by a fine not exceeding two hundred dollars, or imprisonment not exceeding one year or both. If any such rule or regulation relates to a permanent source or act of contamination, said department may impose penalties for the violation thereof or the non-compliance therewith, not exceeding two hundred dollars for every such violation or non-compliance. Every such rule or regulation shall be published at least once in each week for six consecutive weeks, in at least one newspaper of the county where the waters to which it relates are located. The cost of such publication shall be paid by the corporation or municipality benefited by the protection of the water supply to which the rule or regulation published relates. The affidavit of the printer, publisher or proprietor of the newspaper in which the rule or regulation is published may be filed, with the rule or regulation published, in the county clerk's office of such county, and such affidavit and rule and regulation shall be conclusive evidence of such publication, and of all the facts therein stated in all courts and places.

Section 71. Inspection of water supply. The officer or board having by law the management and control of the potable water supply of any municipality, and in the city of New York, the commissioner of water supply, gas and

electricity, or the corporation furnishing such supply, may make such inspection of the sources of such water supply as such officer, board or corporation deems advisable and to ascertain whether the rules and regulations of the State Department and of the commissioner of water supply, gas and electricity of the city of New York, are complied with, and shall make such regular or special inspections as the state commissioner of health, or the commissioner of the department of water supply, gas and electricity of the city of New York, may prescribe. If any such inspection discloses a violation of any rule or regulation relating to a temporary or permanent source or act of contamination, such officer, board or corporation shall cause a copy of the rule or regulation violated to be served upon the person violating the same, with a notice of such violation. If the person served does not immediately comply with the rule or regulation violated, such officer, board or corporation, except in a case concerning the violation of a rule or regulation relating to a temporary or permanent source or act of contamination affecting the potable water supply of the city of New York, shall notify the state Department of the violation, which shall immediately examine into such violation; and if such person is found by the state department to have actually violated such rule or regulation, the commissioner of health shall order the local board of health of such municipality wherein the violation or noncompliance occurs, to convene and enforce obedience to such rule or regulation. If the local board fails to enforce such order within ten days after its receipt, the corporation furnishing such water supply or the municipality deriving its water supply from the waters to which such rule or regulation relates, or the state commissioner of health or the local board of health of the municipality wherein the water supply protected by these rules is used, or any person interested in the protection of the purity of the water supply, may maintain an action in a court of record which shall be tried in the county where the cause of action arose against such person, for the recovery of the penalties incurred by such violation and for an injunction restraining him from the continued violation of such rule or regulation. If the person served does not comply within five days with the rule or regulation violated, in case such rule or regulation relates to a temporary or permanent source or act of contamination affecting the potable water supply of the city of New York, the commissioner of water supply, gas and electricity of said city may summarily enforce compliance with such rule or

regulation, and may summarily abate or remove the cause of the violation of such rule or regulation or the nuisance so created, and to that end may employ such force as may be necessary and proper; provided, however, that no building or improvements shall be removed, disturbed or destroyed by the said commissioner of water supply, gas and electricity until he shall cause measurements to be made of the buildings and photographs of the exterior views thereof, which measurements and photographs shall be at the disposition thereafter of the owners or their attorneys, and failure to exercise such right of abatement shall not be deemed a waiver thereof. Failure to comply within five days with such rule and regulation shall further entitle the city of New York to maintain an action in any court having jurisdiction thereof for the recovery of the penalties incurred by such violation and for an injunction restraining the person or persons violating such rule or regulation, or creating or continuing such nuisance, from the continued violation of such rule or regulation or continuance of such nuisance; the remedy by abatement being not exclusive.

Section 73. Sewerage. When the state department of health, or the commissioner of water supply, gas and electricity of the city of New York, shall, for the protection of a water supply from contamination, make orders or regulations the execution of which will require or make necessary the construction and maintenance of any system of sewerage, or a change thereof, in or for village or hamlet, whether incorporated or unincorporated, or the execution of which will require the providing of some public means of removal or purification of sewage, the municipality or corporation owning the water works benefited thereby shall, at its own expense, construct and maintain such system of sewerage, or change thereof, and provide and maintain such means of removal and purification of sewage and such works or means of sewage disposal as shall be approved by the state department of health, and for that purpose said municipality or corporation may acquire under the general condemnation law, the necessary real estate or interest therein whether now used for public or private purposes. When the execution of any such regulation of the state department of health, or the commissioner of water supply, gas and electricity of the city of New York, will occasion or require the removal of any building or buildings, the municipality or corporation owning the water works benefited thereby shall, at its own expense, remove such buildings and pay to the owner thereof

all damages occasioned by such removal. When the execution of any such regulation will injuriously affect any property the municipality or corporation owning such water works benefited thereby shall make just and adequate compensation for the property so taken or injured and for all injuries caused to the legitimate use or operation of such property. Until such construction or change of such system or systems of sewerage and the providing of such means of removal or purification of sewage, and until such works or means of sewage disposal and the removal of any building are so made by the municipality or corporation owning the water works to be benefited thereby at its own expense, and until, except in the case of a municipality, the corporation owning the water works benefited shall make just and adequate payment for all injuries to property and for all injuries caused to the legitimate use or operation of such property, there shall be no action or proceeding taken by any such municipality, officer, board, person or corporation against any person or corporation for the violation of any regulation of the state department of health under this article, and no person or corporation shall be considered to have violated or refused to obey any such rule or regulation. The owner of any building the removal of which is occasioned or required, or which has been removed by any rule or regulation of the state department of health, or the commissioner of water supply, gas and electricity of the city of New York, made under the provisions of this article, and all persons whose rights or property are injuriously affected by the enforcement of such rule or regulation, shall have a cause of action against the municipality or corporation owning the water works benefited by the enforcement of such rule or regulation, for all damages occasioned or sustained by such removal or enforcement, including all injuries caused to the legitimate use or operation of such property, and an action therefor may be brought against such municipality or corporation in any court of record in the county in which the premises or property affected is situated and shall be tried therein; or such damages may be determined by a special proceeding in the supreme court or the county court of the county in which the property is situated. Such special proceedings shall be commenced by petition and notice to be served by such owner upon the municipality or corporation in the same manner as for the commencement of condemnation proceedings. Such municipality or corporation may make and serve an answer to such petition as in condemnation proceedings. The petition and answer shall set forth the claims of the respective

parties, and the provisions of the condemnation law shall be applicable to the subsequent proceedings upon the petition and answer, if any. Either party may, before the service of the petition or answer respectively, offer to take or pay a certain sum, and no costs shall be awarded against either party unless the judgment is more unfavorable to him than his offer. Provided, however, that in case of a summary abatement by a municipality as hereinbefore provided, no costs shall be awarded against the owner of the property damaged, and the commissioners of appraisal in their report shall recommend such additional sum as may in their judgment be reasonable as compensation for witnesses and other necessary expenses of claimant. Such municipality shall within three calendar months after the confirmation of the report of the commissioners of appraisal, pay to the respective owners and bodies politic or corporate, mentioned or referred to in said report, in whose favor any sum or sums of money shall be estimated and reported by said commissioners, the respective sum or sums of money so estimated and reported in their favor respectively, with lawful interest thereon. And in case of neglect or default in the payment of the same within the time aforesaid, the respective person or persons or bodies politic or corporate in whose favor the same shall be so reported, his, her or their executors, administrators or successors, at any time or times, after application first made by him, her or them to such municipality for payment thereof, may sue for and recover the same, with lawful interest as aforesaid, and the costs of suit in any proper form of action against such municipality in any court having cognizance thereof, and it shall be sufficient to declare generally for so much money due to the plaintiff or plaintiffs therein by virtue of this act, and the report of said commissioners, with proof of the right and title of the plaintiff or plaintiffs to the sum or sums demanded shall be conclusive evidence in such suit or action.

Section 2. Nothing herein contained shall repeal or modify any of the provisions of chapter seven hundred and twenty-four of the laws of nineteen hundred and five, as amended by chapter three hundred and fourteen of the laws of nineteen hundred and six."

Concerning the obligation of water corporations or departments to provide for cost of, or for making of changes or improvements demanded by the rules, but not specifically mentioned in section

73 of the above law, the State Attorney-General has rendered an opinion from which the following is abstracted:

"In my opinion the proper and only lawful construction which can be placed on section 72 * of the Public Health Law is that all damages and injury to the owner of any property affected by changes required to be made to comply with the rules of the Department of Health must be ascertained and paid prior to the taking possession of the property and is a prerequisite to the enforcement of said rules in all cases except such as are a nuisance in and of themselves, in which cases the Department of Health would have power and authority outside of sections 70, 71 and 72 * to abate the same. Any other construction would, to my mind, render the law unconstitutional. In brief, I am of the opinion that the State Department of Health . . . can make and promulgate rules regulating and controlling the use of premises surrounding the sources in all regards, and that a person violating any of these rules can be punished as provided by the penalties, but before such punishment can be inflicted, the corporation for whose benefit the rules are made and established must pay or tender to the owner of the property affected by the enforcement of such rules an amount equal to all damages for making the changes necessary."

ARKPORT

Rules and regulations for the protection from contamination of the public water supply of the village of Arkport, Steuben county.

Rules and Regulations

The rules and regulations hereinafter given, duly made and enacted in accordance with the provisions of sections 70, 71, 72 and 73 of chapter 45 of the Consolidated Laws (Public Health Law) as heretofore set forth shall apply to all natural and artificial reservoirs on the Lime-Kiln creek and all water courses tributary thereto or ultimately discharging into said reservoirs, these bodies of water being sources of the public water supply of the village of Arkport, Steuben county, New York. The term "reservoir" wherever used in these rules is intended to mean and refer to all storage and impounding reservoirs on the Lime-Kiln creek, which are tributary to or which serve as sources of this public water supply or to any additional reservoir which may be constructed or used for the purpose of this public water supply. The term "watercourse" wherever used in these rules is intended to mean and include every spring, pond, (other than the artificial

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* This section (72) of the old Public Health Law is now section 73 of chapter 45 of the Consolidated Laws (Public Health Law).

reservoirs and filter basins) stream, ditch, gutter, or other channel of every kind the waters of which when running whether continuously or occasionally, eventually flow or may flow into the public water supply of the village of Arkport.

Wherever a linear distance of a structure or object from a reservoir or from a watercourse is mentioned in these rules, it is intended to mean the shortest horizontal distance from the nearest point of the structure or object to the high water mark of a reservoir, or to the edge, margin or precipitous bank forming the ordinary highway mark of such watercourse.

Privies Adjacent to Any Reservoir or Watercourse

1. No privy, privy vault, pit, cesspool or any other receptacle of any kind used for either the temporary storage or the permanent deposit of human excreta shall be constructed, placed, maintained, or allowed to remain within one hundred (100) feet of any reservoir or watercourse tributary to the public water supply of the village of Arkport.

2. No privy, privy vault, pit, cesspool or any other receptacle used for the permanent deposit of human excreta, shall be constructed, located, placed, maintained or allowed to remain within three hundred (300) feet of any reservoir or watercourse tributary to the public water supply of the village of Arkport.

3. No cesspool, pit or other receptacle of any kind used for the temporary storage of human excreta or sewage shall be constructed, located, maintained or allowed to remain between the limiting distances prescribed by rule 1 and the limiting distances prescribed by rule 2, unless said cesspool, pit or other receptacle is so arranged and equipped that the said excreta or sewage are at once removed by pump or other satisfactory means through water tight pipes or conduits to some proper place of ultimate disposal, as hereinafter provided; or unless suitable vessels or receptacles for the temporary storage of said human excreta or sewage are provided and at all times maintained in an absolutely water tight condition and in such manner as to permit of convenient removal of said excreta or sewage to some place of ultimate disposal as hereinafter set forth.

4. The excreta collected in the aforesaid temporary receptacles permitted under rule 3 shall be removed and the receptacles thoroughly cleaned and deodorized as often as may be found necessary to maintain the privy in proper sanitary condition and to effectually prevent any overflow upon the soil or upon the foundations or floor of the privy. In affecting this removal the utmost care shall be exercised that none of the contents be allowed to escape while being transferred from the privy to the place of disposal hereinafter specified, and that the contents, while being transferred from the privy to the place of disposal, shall be thoroughly covered and that the least possible annoyance and inconvenience be caused to occupants of the premises and the adjacent premises.

5. Unless otherwise specially ordered or permitted by the State Department of Health, the excreta collected in the aforesaid temporary receptacles permitted under rule 3 shall, when removed, be disposed of by burying in trenches or pits at a depth of not less than 18 inches below the surface and at a distance not less than five hundred (500) feet from any reservoir or watercourse tributary to the public water supply of the village of Arkport.

6. Whenever, owing to the character of the soil or of the surface of the ground, or owing to the height or flow of subsoil or surface water, or other special local conditions it is considered by the State Commissioner of Health that excremental matter from any privy or aforesaid receptacles, or from any trench or place of disposal or the garbage or wastes from any dump, may be washed over the surface or through the soil in an imperfectly purified condition into any reservoir or watercourse, then the said privy or receptacles for excreta or the trench or place of disposal or the said garbage or waste dump, shall, after due notice to the owner thereof, be removed to such greater distance or to such place as shall be considered safe and proper by the State Commissioner of Health.

Sewage, House Slops, Sink Waste, Etc.

7. No house slops, bath water, sewage or other excretal matter from any water closet, privy, cesspool or other source shall be thrown, placed, led, conducted, discharged or allowed to escape or flow in any manner either directly or indirectly into any reservoir or any watercourse tributary to the public water supply of the village of Arkport, nor shall any such matters be thrown, placed, led, discharged or allowed to escape or flow onto the surface of the ground or into the ground beneath the surface, except into watertight receptacles, the contents of which are to be removed as provided by rule 4, within three hundred (300) feet of any reservoir or watercourse tributary to the public water supply of the village of Arkport.

8. No garbage, putrescible matter, kitchen or sink wastes, refuse or waste water, from any creamery, cheese factory, laundry nor water in which milk cans, utensils, clothing, bedding, carpets, or harnesses have been washed or rinsed, nor any polluted water or liquid of any kind shall be thrown or discharged directly or indirectly into any reservoir or watercourse, nor shall any such liquid or solid refuse or waste be thrown, discharged or allowed to escape or remain upon the surface of the ground or to percolate into or through the ground below the surface in any manner whereby the same may flow into any reservoir or watercourse within a distance of two hundred (200) feet from any reservoir or watercourse tributary to the public water supply of the village of Arkport.

9. No clothing, bedding, carpets, harnesses, vehicle, receptacles, utensils, nor anything that pollutes water, shall be washed, rinsed, or placed in any reservoir or watercourse.

Bathing, Animals, Manure, Compost, Etc.

10. No person shall be allowed to bathe in any reservoir or watercourse, nor shall any animals or poultry be allowed to stand, wallow, wade or swim in any reservoir or watercourse, nor be washed therein. The watering of animals or poultry in any reservoir of the public water supply of the village of Arkport is prohibited; nor shall any such watering be allowed in any watercourse tributary to this water supply within one thousand (1,000) feet of said reservoirs. No watering place shall be maintained in such a way as to pollute with muddy leachings or excretal matters any streams tributary to the public water supply of the village of Arkport.

11. No stable for cattle or horses, barnyard, hogyard, pigpen, poultry house or yard, hitching place or standing place for horses or other animals, manure pile or compost heap, shall be constructed, placed, maintained or allowed to remain with its nearest point less than two hundred (200) feet from any reservoir or watercourse tributary to the public water supply of the village of Arkport, and none of the above named objects or sources of pollution shall be so constructed, placed, maintained or allowed to remain where or in such a manner that the drainings, leachings or washings from the same may enter any such reservoir or watercourse without first having passed over or through such an extent of soil as to have been properly purified, and in no case shall it be deemed that proper purification has been secured unless the above drainings, leachings or washings shall have percolated over or through the soil in a scattered, dissipated form, and not concentrated in perceptible lines of drainage for a distance of not less than two hundred (200) feet from any reservoir or watercourse tributary to the public water supply of the village of Arkport.

12. No human excreta and no compost or other matter containing human excreta shall be thrown, placed or allowed to escape into any reservoir or watercourse, nor to be placed, piled or spread upon the surface of the ground at any point on the watershed tributary to the public water supply of the village of Arkport, nor shall such human excreta or compost or other matter containing human excreta be dug or buried in the soil at a less depth than 18 inches below the surface nor within a distance of five hundred (500) feet from any reservoir or watercourse tributary to the public water supply of the village of Arkport and no manure or compost of any kind shall be placed,

piled or spread upon the ground within a distance of one hundred (100) feet from any reservoir or watercourse tributary to the public water supply of the village of Arkport.

13. No decayed or fermented fruit or vegetables, cider mill wastes, roots, grain or other vegetable refuse of any kind shall be thrown, placed, discharged or allowed to escape or pass into any reservoir or watercourse, nor shall they be thrown, placed, piled, maintained or allowed to remain in such places that the drainage, leachings or washings therefrom may flow by open, blind or covered drains or channels of any kind into any reservoir or watercourse without first having passed over or through such an extent of soil as to have been properly purified, and in no case shall it be deemed that sufficient purification has been secured unless the above mentioned drainage, leachings or washings shall have percolated over or through the soil in a scattered, dissipated form, and not concentrated in perceptible lines of drainage, for a distance of not less than one hundred and fifty (150) feet before entering any reservoir or watercourse tributary to the public water supply of the village of Arkport.

Dead Animals, Offal, Manufacturing Waste, Etc.

14. No dead animals, bird, fish or any part thereof nor any offal or waste matter of any kind, shall be thrown, placed, discharged or allowed to escape or to pass into any reservoir or watercourse. Nor shall any such material or refuse be so located, placed, maintained or allowed to remain that the drainage, leachings or washings therefrom may reach any such reservoir or watercourse without having first percolated over or through the soil in a scattered, dissipated form and not concentrated in perceptible lines of drainage, for a distance of two hundred and fifty (250) feet from any reservoir or watercourse tributary to the public water supply of the village of Arkport.

Fishing, Boating and Ice Cutting

15. No boating of any kind, or fishing from boats, or through the ice, or any trespassing whatever shall be allowed in or upon the waters or ice of the reservoirs.

16. No temporary camp, tent, building or other structures for housing laborers engaged on construction work or for other purposes shall be located, placed or maintained within a distance of five hundred (500) feet from any reservoir or watercourse tributary to the public water supply of the village of Arkport.

Cemeteries

17. No interment of a human body shall be made within a distance of three hundred (300) feet from any reservoir or from any watercourse tributary to the public water supply of the village of Arkport.

18. The Board of Trustees of the village of Arkport shall make regular and thorough inspections of the reservoirs, streams and drainage areas tributary thereto for the purpose of ascertaining whether the above rules and regulations are being complied with, and it shall be the duty of said Board of Trustees to cause copies of any rules and regulations violated to be served upon the persons violating the same with notices of such violations; and if such persons served do not immediately comply with the rules and regulations it shall be the further duty of the Board of Trustees to promptly notify the State Commissioner of Health of such violations. The Board of Trustees shall report in writing annually on the first of January, the results of the regular inspections made during the preceding year stating the number of inspections which have been made, the number of violations found, the number of notices served, and the general condition of the watershed at the time of the last inspection.

Penalty

19. In accordance with section 70 of chapter 45 of the Consolidated Laws (Public Health Law), the penalty for each and every violation of or noncompliance with, any of these rules and regulations which relate to a permanent source or act of contamination, is hereby fixed at one hundred (100) dollars.

The foregoing rules and regulations for the protection from contamination of the public water supply of the village of Arkport are hereby duly made, ordained, and established on this eighth day of January, 1915, pursuant to chapter 45 of the Consolidated Laws (Public Health Law) of the State of New York, as amended by chapter 695 of the Laws of 1911.

HERMANN M. BIGGS,
State Commissioner of Health

ALBANY, N. Y.

These rules and regulations to be operative and valid must first be published at least once each week for six consecutive weeks in at least one newspaper in Steuben county and the affidavit of the printer, publisher, or proprietor of each newspaper in which such publication is made, that publication was so made, together with a copy of the rules and regulations, must be filed with the county clerk of that county.

The cost of each such publication, affidavit and filing must be paid by the village of Arkport.

BOVINA CENTER

Rules and regulations for the protection from contamination of the public water supply of the village of Bovina Center, Delaware county.

Rules and Regulations

The rules and regulations hereinafter given, duly made and enacted in accordance with the provisions of sections 70, 71, 72 and 73 of chapter 45 of the Consolidated Laws (Public Health Law), as heretofore set forth, shall apply to all natural and artificial reservoirs on Coulter brook and all watercourses tributary thereto or ultimately discharging into said reservoirs, these bodies of water being sources of the public water supply furnished by the Bovina Center Water Company to the village of Bovina Center, Delaware county, N. Y. The term "reservoir" wherever used in these rules is intended to mean and refer to all storage and impounding reservoirs on the Coulter brook which are tributary to or which serve as sources of this public water supply or to any additional reservoir which may be constructed or used for the purpose of this public water supply. The term "watercourses" wherever used in these rules is intended to mean and include every spring, pond (other than the artificial reservoirs and filter basins), stream, ditch, gutter, or other channel of every kind the waters of which when running, whether continuously or occasionally, eventually flow or may flow into the public water supply of the village of Bovina Center.

Wherever a linear distance of a structure or object from a reservoir or from a watercourse is mentioned in these rules, it is intended to mean the shortest horizontal distance from the nearest point of the structure or object to the high water mark of a reservoir or to the edge, margin or precipitous bank forming the ordinary high water mark of such watercourse.

Privies, Adjacent to Any Reservoir or Watercourse

1. No privy, privy vault, pit, cesspool or any other receptacle of any kind used for either the temporary storage or the permanent deposit of human excreta shall be constructed, placed, maintained, or allowed to remain within seventy-five (75) feet of any reservoir or watercourse tributary to the public water supply of the village of Bovina Center.

2. No privy, privy vault, pit, cesspool or any other receptacle used for the permanent deposit of human excreta shall be constructed, located, placed, maintained or allowed to remain within three hundred (300) feet of any reservoir or watercourse tributary to the public water supply of the Village of Bovina Center.

3. No cesspool, pit or other receptacle of any kind used for the temporary storage of human excreta or sewage shall be constructed, located, maintained or allowed to remain between the limiting distances prescribed by rule 1 and the limiting distances prescribed by rule 2, unless said cesspool, pit or other receptacle is so arranged and equipped that the said excreta or sewage are at once removed by pump or other satisfactory means through watertight pipes or conduits to some proper place of ultimate disposal, as hereinafter provided or unless suitable vessels or receptacles for the temporary storage of said human excreta or sewage are provided and at all times maintained in an absolutely watertight condition and in such manner as to permit of convenient removal of said excreta or sewage to some place of ultimate disposal as hereinafter set forth.

4. The excreta collected in the aforesaid temporary receptacles permitted under rule 3 shall be removed and the receptacles thoroughly cleaned and deodorized as often as may be found necessary to maintain the privy in proper sanitary condition and to effectually prevent any overflow upon the soil or upon the foundation or floor of the privy. In effecting this removal the utmost care shall be exercised that none of the contents be allowed to escape while being transferred from the privy to the place of disposal hereinafter specified, and that the contents, while being transferred from the privy to the place of disposal, shall be thoroughly covered and that the least possible annoyance and inconvenience be caused to occupants of the premises and the adjacent premises.

5. Unless otherwise specially ordered or permitted by the State Department of Health, the excreta collected in the aforesaid temporary receptacles permitted under rule 3 shall, when removed, be disposed of by burying in trenches or pits at a depth of not less than eighteen inches below the surface and at a distance not less than five hundred (500) feet from any reservoir or watercourse tributary to the public water supply of the village of Bovina Center.

6. Whenever, owing to the character of the soil or of the surface of the ground, or owing to the height or flow of subsoil or surface water, or other special local conditions, it is considered by the State Commissioner of Health that excremental matter from any privy or aforesaid receptacles, or from any trench or place of disposal or the garbage or wastes from any dump, may be washed over the surface or through the soil in an imperfectly purified condition into any reservoir or watercourse, then the said privy or receptacles for excreta or the trench or place of disposal or the said garbage or waste dump, shall, after due notice to the owner thereof, be removed to such greater distance or to such place as shall be considered safe and proper by the State Commissioner of Health

Sewage, House Slops, Sink Waste, Etc.

7. No house slops, bath water, sewage or other excretal matter from any water closet, privy, cesspool or other source shall be thrown, placed, led, conducted, discharged or allowed to escape or flow in any manner either directly or indirectly into any reservoir or any watercourse tributary to the public water supply of the village of Bovina Center, nor shall any such matters be thrown, placed, led, discharged or allowed to escape beneath the surface except into watertight receptacles, the contents of which are to be removed as provided by rule 4 within three hundred (300) feet of any reservoir or watercourse tributary to the public water supply of the village of Bovina Center.

8. No garbage, putrescible matter, kitchen or sink wastes, refuse or waste water, from any creamery, cheese factory, laundry, nor water in which milk cans, utensils, clothing, bedding, carpets, or harness have been washed or rinsed, nor any polluted water or liquid of any kind shall be thrown or discharged directly or indirectly into any reservoir or watercourse nor shall any such liquid or solid refuse or waste be thrown, discharged or allowed to escape or remain upon the surface of the ground or to percolate into or through the ground below the surface in any manner whereby the same may flow into any reservoir or watercourse within a distance of one hundred (100) feet from

any reservoir or watercourse tributary to the public water supply of the village of Bovina Center.

9. No clothing, bedding, carpets, harnesses, vehicle, receptacles, utensils nor anything that pollutes water, shall be washed, rinsed, or placed in any reservoir or watercourse.

Bathing, Animals, Manure, Compost, Etc.

10. No person shall be allowed to bathe in any reservoir or watercourse, nor shall any animals or poultry be allowed to stand, wallow, wade or swim in any reservoir or watercourse, nor be washed therein. The watering of animals or poultry in any reservoir of the public water supply of the village of Bovina Center is prohibited. No watering place shall be maintained in such a way as to pollute with muddy leachings or excretal matters any streams tributary to the public water supply of the village of Bovina Center.

11. No stable for cattle or horses, barnyard, hogyard, pig-pen, poultry house or yard, hitching place or standing place for horses or other animals, manure pile or compost heap shall be constructed, placed, maintained or allowed to remain with its nearest point less than seventy-five (75) feet from any reservoir or watercourse tributary to the public water supply of the village of Bovina Center and none of the above named objects or sources of pollution shall be so constructed, placed, maintained or allowed to remain where or in such a manner that the drainings, leachings or washings from the same may enter any such reservoir or watercourse without first having passed over or through such an extent of soil as to have been properly purified, and in no case shall it be deemed that proper purification has been secured unless the above drainings, leachings or washings shall have percolated over or through the soil in a scattered, dissipated form, and not concentrated in perceptible lines of drainage for a distance of not less than seventy-five (75) feet from any reservoir or watercourse tributary to the public water supply of the village of Bovina Center.

12. No human excreta and no compost or other matter containing human excreta shall be thrown, placed or allowed to escape into any reservoir or watercourse, nor be placed, piled or spread upon the surface of the ground at any point on the watershed tributary to the public water supply of the village of Bovina Center, nor shall such human excreta or compost or other matter containing human excreta be dug or buried in the soil at a less depth than 18 inches below the surface nor within a distance of five hundred (500) feet from any reservoir or watercourse tributary to the public water supply of the village of Bovina Center and no manure or compost of any kind shall be placed, piled or spread upon the ground within a distance of seventy-five (75) feet from any reservoir or watercourse tributary to the public water supply of the village of Bovina Center.

13. No decayed or fermented fruit or vegetables, cider mill wastes, roots, grain or other vegetable refuse of any kind shall be thrown, placed, discharged or allowed to escape or pass into any reservoir or watercourse, nor shall they be thrown, placed, piled, maintained or allowed to remain in such places that the drainage, leachings or washings therefrom may flow by open, blind or covered drains or channels of any kind into any reservoir or watercourses without first having passed over or through such an extent of soil as to have been properly purified, and in no case shall it be deemed that sufficient purification has been secured unless the above mentioned drainings, leachings or washings shall have percolated over or through the soil in a scattered, dissipated form, and not concentrated in perceptible lines of drainage for a distance of not less than seventy-five (75) feet before entering any reservoir or watercourse tributary to the public water supply of the village of Bovina Center.

Dead Animals, Offal, Manufacturing Wastes, Etc.

14. No dead animals, bird, fish or any part thereof nor any offal or waste matter of any kind, shall be thrown, placed, discharged or allowed to escape or to pass into any reservoir or watercourse. Nor shall any such material

or refuse be so located, placed, maintained or allowed to remain that the drainage, leachings or washings therefrom may reach any such reservoir or watercourse without having first percolated over or through the soil in a scattered, dissipated form and not concentrated in perceptible lines of drainage for a distance of two hundred (200) feet from any reservoir or watercourse tributary to the public water supply of the village of Bovina Center.

Fishing, Boating, and Ice Cutting

15. No boating of any kind, or fishing from boats, or through the ice, or any trespassing whatever shall be allowed in or upon the waters or ice of the reservoir.

16. No temporary camp, tent, building or other structure for housing laborers engaged on construction work or for other purposes shall be located placed or maintained within a distance of five hundred (500) feet from any reservoir or watercourse tributary to the public water supply of the village of Bovina Center.

Cemeteries

17. No interment of a human body shall be made within a distance of two hundred (200) feet from any reservoir or from any watercourse tributary to the public water supply of the village of Bovina Center.

18. The Bovina Center Water Company shall make regular and thorough inspections of the reservoirs, streams and drainage areas tributary thereto for the purpose of ascertaining whether the above rules and regulations are being complied with, and it shall be the duty of said water company to cause copies of any rules and regulations violated to be served upon the persons violating the same with notices of such violations: and if such persons served do not immediately comply with the rules and regulations it shall be the further duty of the water company to promptly notify the State Commissioner of Health of such violations. The water company shall report in writing annually on the first of January, the results of the regular inspections made during the preceding year, stating the number of inspections which have been made, the number of violations found, the number of notices served, and the general condition of the watershed at the time of the last inspection.

Penalty

19. In accordance with section 70 of chapter 45 of the Consolidated Laws (Public Health Law), the penalty for each and every violation of or noncompliance with, any of these rules and regulations which relate to a permanent source or act of contamination, is hereby fixed at one hundred (100) dollars.

The foregoing rules and regulations for the protection from contamination of the public water supply of the village of Bovina Center are hereby duly made, ordained, and established on this 19th day of November, 1915, pursuant to chapter 45 of the Consolidated Laws (Public Health Law) of the State of New York, as amended by chapter 695 of the Laws of 1911.

HERMANN M. BIGGS,
State Commissioner of Health

ALBANY, N. Y.

These rules and regulations to be operative and valid must first be published at least once each week for six consecutive weeks in at least one newspaper in Delaware county, and the affidavit of the printer, publisher, or proprietor of each newspaper in which such publication is made, that publication was so made, together with a copy of the rules and regulations, must be filed with the county clerk of that county.

The cost of each such publication, affidavit and filing must be paid by the Bovina Center Water Company.

HAVERSTRAW

In the matter of the amendment to the Rules and Regulations for the Protection from Contamination of the Public Water Supply furnished by the Haverstraw Water Supply Company, established by the State Department of Health on July 14, 1910.

In response to an application made by the Palisades Interstate Park Commission in connection with an agreement made between the said Commission and the Haverstraw Water Supply Company for the construction of a modern water filtration plant for the purification of the water supply furnished by the said water company from Cedar Pond brook and its tributaries and after a careful consideration of the questions involved, it is

Hereby ordered, That the rules and regulations heretofore established for the protection from contamination of the public water supply furnished by the Haverstraw Water Supply on July 14, 1910, shall be changed and amended with reference to rules 10 and 15 as hereinafter set forth.

For the purpose of regulating bathing, fishing, boating and ice cutting (restricted under Rules 10 and 15) according to the danger of pollution arising in proportion to the remoteness from the intake of the Haverstraw Water Supply Company the drainage area will be considered as consisting of two separate districts as follows:

District A shall include that portion of the watershed tributary to Cedar Pond Brook between the water works intake and a point two miles up stream from this intake.

District B shall include the remaining area tributary to Cedar Pond Brook beyond the point two miles up stream from the water works intake.

With reference to bathing, etc. Rule 10 shall be changed and amended to read as follows:

Rule 10. Within District A, no person shall be allowed to bathe in any reservoir or water course nor shall any animal or poultry be allowed to stand, wallow, wade or swim in said reservoir or watercourse, nor be washed therein.

Within District B, bathing will be permitted in reservoirs and watercourses, providing said bathing is carried on in strict accordance with rules and regulations which may be established by the Haverstraw Water Supply Company, subject to review and amendment by the State Commissioner of Health, for the sanitary protection of their water supply and providing a modern filtration plant for this water supply is in operation.

With reference to fishing, boating and ice cutting Rule 15 shall be changed and amended to read as follows:

Rule 15. Within District A, no fish shall be taken from any reservoir or watercourse, nor shall any person fish in any reservoir or watercourse or through the ice upon the same, nor trespass upon the waters of any reservoir or watercourse or the ice thereon nor maintain or use any boat or boats thereon except the officials or duly authorized employees of the Haverstraw Water Supply Company in the exercise of their duties in the management and operation of the reservoir; nor shall any person or persons cut or remove any ice from any of the reservoirs within District A which form or are tributary to the sources of the public water supply furnished by the Haverstraw Water Supply Company.

Within District B, fishing, boating and ice cutting may be carried on providing such operations are conducted with strict sanitary precautions for adequately safeguarding the waters of this public water supply and providing said operations are carried on in strict accordance with such rules and restrictions as may be established by the Haverstraw Water Supply Company subject to review and amendment by the State Commissioner of Health.

The foregoing amendments to the Rules and Regulations for the protection from contamination of the public water supply of the Haverstraw Water

Supply Company of Haverstraw, Rockland county, N. Y., were duly made, ordained and established on this 2d day of April, 1915, pursuant to the provisions of the Public Health Law, constituting chapter 45 of the Consolidated Laws.

HERMANN M. BIGGS,
State Commissioner of Health

ALBANY, N. Y.

This amendment of the rules and regulations to be operative and valid, must first be published at least once each week for six consecutive weeks in at least one newspaper in Rockland county, N. Y., and the affidavit of the printer, publisher, or proprietor of each newspaper in which such publication is made, that the publication was so made together with a copy of the amendment to the rules and regulations, must be filed with the County Clerk of that county.

The cost of each such publication, affidavit and filing must be paid by the Haverstraw Water Supply Company.

MORRIS

Rules and regulations for the protection from contamination of the public water supply of the village of Morris, Otsego county.

Rules and Regulations

The rules and regulations hereinafter given, duly made and enacted in accordance with the provisions of sections 70, 71, 72 and 73 of chapter 45 of the Consolidated Laws (Public Health Law) as heretofore set forth shall apply to all natural and artificial reservoirs and all watercourses tributary thereto or ultimately discharging into said reservoirs, these bodies of water being sources of the public water supply of the village of Morris, Otsego county, New York. The term "reservoir" whenever used in these rules is intended to mean and refer to all storage and impounding reservoirs which are tributary to or which serve as sources of this public water supply or to any additional reservoir which may be constructed or used for the purpose of this public water supply. The term "watercourse" wherever used in these rules is intended to mean and include every spring, pond (other than the artificial reservoirs and filter basins), stream, ditch, gutter, or other channel of every kind the waters of which when running whether continuously or occasionally, eventually flow or may flow into the public water supply of the village of Morris.

Wherever a linear distance of a structure or object from a reservoir or from a watercourse is mentioned in these rules, it is intended to mean the shortest horizontal distance from the nearest point of the structure or object to the high-water mark of a reservoir or to the edge, margin or precipitous bank forming the ordinary high-water mark of such watercourse.

Privies Adjacent to Any Reservoir or Watercourse

1. No privy, privy vault, pit, cesspool or any other receptacle of any kind used for either the temporary storage or the permanent deposit of human excreta shall be constructed, placed, maintained, or allowed to remain within seventy-five (75) feet of any reservoir or watercourse tributary to the public water supply of the village of Morris.

2. No privy, privy vault, pit, cesspool or any other receptacle used for the permanent deposit of human excreta, shall be constructed, located, placed, maintained or allowed to remain within two hundred and fifty (250) feet of

4. In approved locations and where conditions of soil and topography are favorable, water-flushed toilets and other inside plumbing may be used, if connected by approved water-tight pipes with an approved sewage disposal system.

House Slops

5. House slops, sink wastes, laundry water or sewage of any kind shall not be thrown on the ground or discharged in such manner as to become offensive or to result in or threaten the pollution of a watercourse or reservoir. Whenever large quantities of polluting solid matter or polluted liquid are to be disposed of, application shall be made to the Board of Water Supply for the approval of a satisfactory method of disposal.

Garbage, Refuse, Compost, Manure and Dead Animals

6. No garbage or putrescible refuse of any kind shall be thrown or discharged directly into any watercourse or reservoir, nor shall the disposal be such as to result in or threaten pollution.

7. Compost heaps, or masses of fermented or decayed foods, vegetables, roots, grain, sawdust, leaves or other vegetable substances shall not be maintained in such manner as to result in or threaten pollution.

8. No dead animal of any kind, nor any part thereof, shall be thrown into any watercourse or reservoir or buried in such manner as to form a source of pollution.

Stables and Slaughter Houses

9. No stable, pig-sty, chicken-house, barn-yard, hog-yard, slaughter house, hitching or standing place for horses and cattle or any other place where dung or urine accumulates shall be constructed, located and maintained so as to form a source of pollution.

Factory Wastes

10. No filth, decaying or putrescible matter, waste product or polluted liquid from any factory, creamery, mill, tannery, garage or establishment of any other kind shall be discharged, drained or washed directly into any watercourse or reservoir. Application shall be made to the Board of Water Supply for the approval of a satisfactory method for the disposal of such objectionable matters.

Washing, Bathing and Swimming

11. No animals of any kind shall be washed in any watercourse or reservoir owned by the city. No clothes or other articles shall be washed in any watercourse or reservoir.

12. No bathing, swimming nor washing shall be done in any watercourse or reservoir owned by the city.

Cemeteries

13. No interment shall be made in any cemetery or other place of burial in such manner as to result in pollution of a watercourse or reservoir.

Disposal Systems

14. Every existing system for treating excremental matter, wastes or discharges of any kind from any dwelling, hotel, stable, garage, factory or other building, wherein such wastes or discharges constitute a source of pollution, shall be modified in a manner satisfactory to the Board of Water Supply.

15. All new systems for the treatment of excremental matter, wastes and discharges of any kind shall receive the approval of the Board of Water Supply before such system is installed.

Enforcement and Appeal

The Board of Water Supply shall have the right to enforce compliance with any of these rules and regulations, but in case any person or corporation believes that the requirements of the Board of Water Supply are unnecessary

or unreasonable, he may appeal to the State Department of Health, which may modify the requirements of the Board of Water Supply or affirm them, each case being judged on its merits as affecting the general health of the people of the State and the city.

Penalty

Section 70 of the Public Health Law provides that any person violating any of these rules and regulations is liable to prosecution for misdemeanor and on conviction may be punished by a fine not exceeding two hundred (200) dollars or by imprisonment not exceeding one year, or both.

Approval

The foregoing rules and regulations are hereby approved, pursuant to chapter 665 of the Laws of 1915.

HERMANN M. BIGGS,
State Commissioner of Health

Dated, November 17, 1915

NORTH TARRYTOWN

Rules and regulations for the protection from contamination of the public water supply furnished by the consolidated water company of suburban New York to the village of North Tarrytown and neighboring communities in Westchester county from the Pocantico river.

Rules and Regulations

The rules and regulations hereinafter given, duly made and enacted in accordance with the provisions of sections 70, 71, 72 and 73 of chapter 45 of the Consolidated Laws (Public Health Law) as heretofore set forth shall apply to all natural and artificial reservoirs on the Pocantico river and all watercourses tributary thereto or ultimately discharging into said reservoirs, those bodies of water being sources of the public water supply furnished by the Consolidated Water Company of Suburban New York to the village of North Tarrytown and to other nearby communities in Westchester county, New York. The term "reservoir" wherever used in these rules is intended to mean and refer to all storage and impounding reservoirs on the Pocantico River which are tributary to or which serve as sources of this public water supply or to any additional reservoir which may be constructed or used for the purpose of this public water supply. The term "watercourse" wherever used in these rules is intended to mean and include every spring, pond, (other than the artificial reservoirs and filter basins) stream, ditch, gutter, or other channel of every kind, the waters of which when running, whether continuously or occasionally, eventually flow, or may flow, into the water supply furnished by the Consolidated Water Company of Suburban New York.

Wherever a linear distance of a structure or object from a reservoir or from a watercourse is mentioned in these rules, it is intended to mean the shortest horizontal distance from the nearest point of the structure or object to the high water mark of a reservoir, or to the edge, margin or precipitous bank forming the ordinary high water mark of such watercourse.

Privies Adjacent to Any Reservoir or Watercourse

1. No privy, privy vault, pit, cesspool or any other receptacle of any kind used for either the temporary storage or the permanent deposit of human

excreta shall be constructed, placed, maintained, or allowed to remain within seventy-five (75) feet of any reservoir or any watercourse tributary to the public water supply furnished by the Consolidated Water Company of Suburban New York.

2. No privy, privy vault, pit, cesspool or any other receptacle used for the permanent deposit of human excreta, shall be constructed, located, placed, maintained or allowed to remain within three hundred (300) feet of any reservoir or any watercourse tributary to the public water supply furnished by the Consolidated Water Company of Suburban New York.

3. Every privy, privy vault, pit or other receptacle or place used for the temporary storage of human excreta which is constructed, located, maintained or allowed to remain between the limiting distances prescribed by Rule (1) and the limiting distances prescribed by Rule (2) from which privy or other receptacle the excreta are not at once removed by pump or other satisfactory means through watertight pipes or conduits to some proper place of ultimate disposal, as hereinafter provided, shall be arranged in such manner that all such excreta shall be received temporarily in suitable vessels or receptacles which shall at all times be maintained in an absolutely watertight condition and which will permit of convenient removal to some place of ultimate disposal as hereinafter set forth.

4. The excreta collected in the aforesaid temporary receptacles permitted under Rule (3) shall be removed and the receptacles thoroughly cleaned and deodorized as often as may be found necessary to maintain the privy in proper sanitary condition and to effectually prevent any overflow upon the soil or upon the foundations or floor of the privy. In effecting this removal the utmost care shall be exercised that none of the contents be allowed to escape while being transferred from the privy to the place of disposal hereinafter specified, and that the contents, while being transferred from the privy to the place of disposal, shall be thoroughly covered and that the least possible annoyance and inconvenience be caused to occupants of the premises and the adjacent premises.

5. Unless otherwise specially ordered or permitted by the State Department of Health, the excreta collected in the aforesaid temporary receptacles permitted under Rule (3) shall, when removed, be disposed of by burying in trenches or pits at a depth of not less than 18 inches below the surface and at a distance not less than five hundred (500) feet from any reservoir or any watercourse tributary to the public water supply furnished by the Consolidated Water Company of Suburban New York.

6. Whenever, owing to the character of the soil or of the surface of the ground, or owing to the height or flow of subsoil or surface water, or other special local conditions, it is considered by the State Commissioner of Health that excremental matter from any privy or aforesaid receptacles, or from any trench or place of disposal, or the garbage or wastes from any dump, may be washed over the surface or through the soil in an imperfectly purified condition into any reservoir or watercourse, then the said privy or receptacles for excreta or the trench or place of disposal or the said garbage or waste dump, shall, after due notice to the owner thereof, be removed to such greater distance or to such place as shall be considered safe and proper by the State Commissioner of Health.

Sewage, House Slops, Sink Wastes, Etc.

7. No house slops, bath water, sewage or other excretal matter from any water closet, privy, cesspool or other source, except the purified effluent from a properly constructed sewage disposal plant approved as required by law, shall be thrown, placed, led, conducted, discharged or allowed to escape or flow in any manner either directly or indirectly into any reservoir or any watercourse tributary to the public water supply furnished by the Consolidated Water Company of Suburban New York, nor shall any such matters be thrown, placed, led, discharged or allowed to escape or flow onto the surface of the ground or into the ground beneath the surface, except into water-tight receptacles, the contents of which are to be removed as provided

by Rule 4, within two hundred (200) feet of any reservoir or any watercourse tributary to the public water supply furnished by the Consolidated Water Company of Suburban New York.

8. No garbage, putrescible matter, kitchen or sink wastes, refuse or waste water, from any creamery, cheese factory, laundry nor water in which milk cans, utensils, clothing, bedding, carpets or harnesses have been washed or rinsed, nor any polluted water or liquid of any kind shall be thrown or discharged directly or indirectly into any reservoir or watercouse, nor shall any such liquid or solid refuse or waste be thrown, discharged or allowed to escape or remain upon the surface of the ground or to percolate into the ground or through the ground below the surface in any manner whereby the same may flow into any reservoir or watercourse within a distance of one hundred (100) feet from any reservoir or any watercourse tributary to the public water supply furnished by the Consolidated Water Company of Suburban New York.

(9) No clothing, bedding, carpets, harness, vehicle, receptacles, utensils, nor anything that pollutes water, shall be washed, rinsed, or placed in any reservoir or watercourse.

Bathing, Animals, Manure, Compost, Etc.

10. No person shall be allowed to bathe in any reservoir or watercourse, nor shall any animals or poultry be allowed to stand, wallow, wade or swim in any reservoir or watercourse nor be washed therein. The watering of animals or poultry in any reservoir of the Consolidated Water Company of Suburban New York is prohibited, nor shall any such watering be allowed in any tributary stream within one thousand (1000) feet of said reservoirs. No watering place shall be maintained in such a way as to pollute by muddy leachings or excretal matters any streams tributary to the public water supply furnished by the Consolidated Water Company of Suburban New York.

Cattle or livestock shall not be pastured or allowed to graze within twenty-five (25) feet of any reservoir or within twenty-five (25) feet of the banks of any tributary watercourse at any point within one mile of any reservoir of the Consolidated Water Company of Suburban New York.

11. No stable for cattle or horses, barn-yard, hog-yard, pig-pen, poultry-house or yard, hitching place or standing place for horses or other animals, manure pile or compost heap, shall be constructed, placed, maintained or allowed to remain with its nearest point less than one hundred and fifty (150) feet from any reservoir or any watercourse tributary to the public water supply furnished by the Consolidated Water Company of Suburban New York, and none of the above named objects or sources of pollution shall be so constructed, placed, maintained or allowed to remain where or in such a manner that the drainings, leachings or washings from the same may enter any such reservoir or watercourse without first having been passed over or through such an extent of soil as to have been properly purified, and in no case shall it be deemed that proper purification has been secured unless the above drainage, leachings or washings shall have percolated over or through the soil in a scattered, dissipated form, and not concentrated in perceptible lines of drainage for a distance of not less than one hundred and fifty (150) feet from any reservoir or any watercourse tributary to the public water supply furnished by the Consolidated Water Company of Suburban New York.

12. No human excreta, compost or other matter containing same shall be thrown, placed, or allowed to escape into any reservoir or watercourse, nor be placed, piled, or spread upon the ground at any point on any watershed tributary to the public water supply furnished by the Consolidated Water Company of Suburban New York; nor shall such human excreta, compost or other matter containing the same be dug or buried in the soil at a less depth than 18 inches below the surface nor within a distance of three hundred (300) feet from any reservoir or any watercourse tributary to the public water supply furnished by the Consolidated Water Company of Suburban New York, and no manure or compost of any kind shall be placed, piled or spread upon the ground within a distance of one hundred (100) feet from any

reservoir or any watercourse tributary to the public water supply furnished by the Consolidated Water Company of Suburban New York.

13. No decayed or fermented fruit or vegetables, cider mill wastes, roots, grain or other vegetable refuse of any kind shall be thrown, placed, discharged or allowed to escape or pass into any reservoir or watercourse, nor shall they be thrown, placed, piled, maintained or allowed to remain in such places that the drainage, leachings or washings therefrom may flow by open, blind or covered drains or channels of any kind into any reservoir or watercourse without first having passed over or through such an extent of soil as to have been properly purified, and in no case shall it be deemed that sufficient purification has been secured unless the above mentioned drainings, leachings or washings shall have percolated over or through the soil in a scattered, dissipated form, and not concentrated in perceptible lines of drainage, for a distance of not less than one hundred (100) feet before entering any reservoir or any watercourse tributary to the public water supply furnished by the Consolidated Water Company of Suburban New York.

Dead Animals, Offal, Manufacturing Waste, Etc.

14. No dead animals, bird, fish, or any part thereof, nor any offal or waste matter of any kind, shall be thrown, placed discharged or allowed to escape or to pass into any reservoir, or watercourse. Nor shall any such material or refuse be so located, placed, maintained or allowed to remain that the drainage, leachings, or washings therefrom may reach any such reservoir or watercourse without having first percolated over or through the soil in a scattered, dissipated form and not concentrated in perceptible lines of drainage, for a distance of two hundred (200) feet from any reservoir or any watercourse tributary to the public water supply furnished by the Consolidated Water Company of Suburban New York.

Fishing, Boating and Ice Cutting

15. No boating of any kind, or fishing from boats, or through the ice, or any trespassing whatever shall be allowed in or upon the waters or ice of the reservoirs, except by written permission and in strict compliance with the regulations to be adopted by the Consolidated Water Company of Suburban New York; nor in any manner that may pollute the waters of this public water supply. All ice cutting shall be done under rigid inspection and supervision of the Consolidated Water Company of Suburban New York.

16. No temporary camp, tent, building or other structure for housing laborers engaged on construction work or for other purposes shall be located, placed or maintained within a distance of five hundred (500) feet from any reservoir or watercourse tributary to the public water supply furnished by the Consolidated Water Company of Suburban New York.

Cemeteries

17. No interment of a human body shall be made within a distance of three hundred (300) feet from any reservoir or from any watercourse tributary to the public water supply furnished by the Consolidated Water Company of Suburban New York.

18. The Consolidated Water Company of Suburban New York shall make regular and thorough inspections of the reservoirs, streams and drainage areas tributary thereto for the purpose of ascertaining whether the above rules and regulations are being complied with, and it shall be the duty of said Consolidated Water Company of Suburban New York to cause copies of any rules and regulations violated to be served upon the persons violating the same with notices of such violations; and if such persons served do not immediately comply with the rules and regulations, it shall be the further duty of the Consolidated Water Company of Suburban New York to promptly notify the State Commissioner of Health of such violations. The Consolidated Water Company of Suburban New York shall report in writing annually on the first of January, the results of the regular inspections made during the preceding year, stating the number of inspections which have been made, the number of violations found, the number of notices served, and the general *condition* of the watershed at the time of the last inspection.

Penalty

19. In accordance with section 70 of chapter 45 of the Consolidated Laws (Public Health Law), the penalty for each and every violation of or non-compliance with, any of these rules and regulations which relate to a permanent source or act of contamination, is hereby fixed at one hundred (100) dollars.

The foregoing rules and regulations for the protection from contamination of the public water supply furnished by the Consolidated Water Company of Suburban New York to the village of North Tarrytown and other nearby communities in Westchester county, are hereby duly made, ordained and established on this 17th day of February, 1915, pursuant to chapter 45 of the Consolidated Laws (Public Health Law) of the State of New York, as amended by chapter 695 of the Laws of 1911.

HERMANN M. BIGGS,
ALBANY, N. Y. *State Commissioner of Health*

These rules and regulations to be operative and valid must first be published at least once each week for six consecutive weeks in at least one newspaper in Westchester county, and the affidavit of the printer, publisher, or proprietor of each newspaper in which such publication is made, that the publication was so made, together with a copy of the rules and regulations, must be filed with the county clerk of that county.

The cost of each such publication, affidavit and filing must be paid by the Consolidated Water Company of Suburban New York.

SYLVAN BEACH

Rules and regulations for the protection from contamination of the public water supply furnished by the Sylvan Spring Water Company to the village of Sylvan Beach and neighboring communities in Oneida county from Hollenbeck and Roantree reservoirs.

Rules and Regulations

The rules and regulations hereinafter given, duly made and enacted in accordance with the provisions of sections 70, 71, 72 and 73 of chapter 45 of the Consolidated Laws (Public Health Law), as heretofore set forth, shall apply to the Hollenbeck and Roantree reservoirs and all watercourses tributary thereto or ultimately discharging into said reservoirs, these bodies of water being sources of the public water supply furnished by the Sylvan Spring Water Company to the village of Sylvan Beach and other nearby communities in Oneida county, New York. The term "reservoir," wherever used in these rules, is intended to mean and refer to the Hollenbeck and Roantree reservoirs which serve as sources of this public water supply or to any additional reservoir which may be constructed or used for the purpose of this public water supply. The term "watercourse," wherever used in these rules, is intended to mean and include every spring, pond (other than the artificial reservoirs and filter basins), stream, ditch, gutter or other channel of every kind, the waters of which when running, whether continuously or occasionally, eventually flow, or may flow into the public water supply furnished by the Sylvan Spring Water, Company.

Wherever a linear distance of a structure or object from a reservoir or from a watercourse is mentioned in these rules it is intended to mean the shortest horizontal distance from the nearest point of the structure or object to the high-water mark of a reservoir, or to the edge, margin or precipitous bank forming the ordinary high-water mark of such watercourse.

Privies Adjacent to any Reservoir or Watercourse

1. No privy, privy vault, pit, cesspool or any other receptacle of any kind used for either the temporary storage or the permanent deposit of human excreta shall be constructed, placed, maintained or allowed to remain within one hundred (100) feet of any reservoir or watercourse tributary to the public water supply furnished by the Sylvan Spring Water Company.

2. No privy, privy vault, pit, cesspool or any other receptacle used for the permanent deposit of human excreta, shall be constructed, located, placed, maintained or allowed to remain within three hundred (300) feet of any reservoir or watercourse tributary to the public water supply furnished by the Sylvan Spring Water Company.

3. Every privy, privy vault, pit or other receptacle or place used for the temporary storage of human excreta which is constructed, located, maintained or allowed to remain between the limiting distances prescribed by Rule (1) and the limiting distances prescribed by Rule (2) from which privy or other receptacle the excreta are not at once removed by pump or other satisfactory means through watertight pipes or conduits to some proper place of ultimate disposal, as hereinafter provided, shall be arranged in such manner that all such excreta shall be received temporarily in suitable vessels or receptacles which shall at all times be maintained in an absolutely watertight condition and which will permit of convenient removal to some place of ultimate disposal as hereinafter set forth.

4. The excreta collected in the aforesaid temporary receptacles permitted under Rule (3) shall be removed and the receptacles thoroughly cleaned and deodorized as often as may be found necessary to maintain the privy in proper sanitary condition and to effectually prevent any overflow upon the soil or upon the foundations or floor of the privy. In effecting this removal the utmost care shall be exercised that none of the contents be allowed to escape while being transferred from the privy to the place of disposal hereinafter specified, and that the contents, while being transferred from the privy to the place of disposal, shall be thoroughly covered and that the least possible annoyance and inconvenience be caused to occupants of the premises and the adjacent premises.

5. Unless otherwise specially ordered or permitted by the State Department of Health, the excreta collected in the aforesaid temporary receptacles permitted under Rule (3) shall, when removed, be disposed of by burying in trenches or pits at a depth of not less than eighteen inches below the surface and at a distance not less than five hundred (500) feet from any reservoir or watercourse tributary to the public water supply furnished by the Sylvan Spring Water Company.

6. Whenever, owing to the character of the soil or of the surface of the ground, or owing to the height or flow of subsoil or surface water, or other special local conditions, it is considered by the State Commissioner of Health that excremental matter from any privy or aforesaid receptacles, or from any trench or place of disposal, or the garbage or wastes from any dump, may be washed over the surface or through the soil in an imperfectly purified condition into any reservoir or watercourse, then the said privy or receptacles for excreta or the trench or place of disposal or the said garbage or waste dump, shall, after due notice to the owner thereof, be removed to such greater distance or to such place as shall be considered safe and proper by the State Commissioner of Health.

Sewage, House Slops, Sink Wastes, Etc.

7. No house slops, bath water, sewage or other excretal matter from any water closet, privy, cesspool or other source shall be thrown, placed, led, conducted, discharged or allowed to escape or flow in any manner either directly or indirectly into any reservoir or watercourse tributary to the public water supply furnished by the Sylvan Spring Water Company, nor shall any such matters be thrown, placed, led, discharged, or allowed to escape or flow onto the surface of the ground or into the ground beneath the surface, except

into watertight receptacles the contents of which are to be removed as provided by Rule 4, within three hundred (300) feet of any reservoir or watercourse tributary to the public water supply furnished by the Sylvan Spring Water Company.

8. No garbage, putrescible matter, kitchen or sink wastes, refuse or waste water, from any creamery, cheese factory, laundry nor water in which milk cans, utensils, clothing, bedding, carpets or harnesses have been washed or rinsed, nor any polluted water or liquid of any kind shall be thrown or discharged directly or indirectly into any reservoir or watercourse, nor shall any such liquid or solid refuse or waste be thrown, discharged or allowed to escape or remain upon the surface of the ground or to percolate into or through the ground below the surface in any manner whereby the same may flow into any reservoir or watercourse within a distance of one hundred and fifty (150) feet from any reservoir or watercourse tributary to the public water supply furnished by the Sylvan Spring Water Company.

9. No clothing, bedding, carpets, harness, vehicle, receptacles, utensils, nor anything that pollutes water, shall be washed, rinsed, or placed in any reservoir or watercourse.

Bathing, Animals, Manure, Compost, Etc.

10. No person shall be allowed to bathe in any reservoir or watercourse, nor shall any animals or poultry be allowed to stand, wallow, wade or swim in any reservoir or watercourse, nor be washed therein. The watering of animals or poultry in any reservoir of the public water supply furnished by the Sylvan Springs Water Company is prohibited; nor shall any such watering be allowed in any watercourse tributary to this water supply within one thousand (1,000) feet of said reservoir. No watering place shall be maintained in such a way as to pollute with muddy leachings or excretal matters any streams tributary to the public water supply furnished by the Sylvan Spring Water Company.

11. No stable for cattle or horses, barnyard, hogyard, pigpen, poultry house or yard, hitching place or standing place for horses or other animals, manure pile or compost heap, shall be constructed, placed, maintained or allowed to remain with its nearest point less than one hundred and fifty (150) feet from any reservoir or watercourse tributary to the public water supply furnished by the Sylvan Spring Water Company, and none of the above named objects or sources of pollution shall be so constructed, placed, maintained or allowed to remain where or in such a manner that the drainings, leachings or washings from the same may enter any such reservoir or watercourse without first having passed over or through such an extent of soil as to have been properly purified, and in no case shall it be deemed that proper purification has been secured unless the above drainings, leachings or washings shall have percolated over or through the soil in a scattered, dissipated form, and not concentrated in perceptible lines of drainage for a distance of not less than one hundred and fifty (150) feet from any reservoir or watercourse tributary to the public water supply furnished by the Sylvan Spring Water Company.

12. No human excreta, compost or other matter containing the same shall be thrown, placed or allowed to escape into any reservoir or watercourse, nor be placed, piled or spread upon the ground at any point on any watershed tributary to the public water supply furnished by the Sylvan Spring Water Company; nor shall such human excreta, compost or other matter containing the same be dug or buried in the soil at a less depth than 18 inches below the surface nor within five hundred (500) feet from any reservoir or watercourse tributary to the public water supply furnished by the Sylvan Spring Water Company, and no manure or compost of any kind shall be placed, piled or spread upon the ground within a distance of one hundred and fifty (150) feet from any reservoir or watercourse tributary to the public water supply furnished by the Sylvan Spring Water Company.

13. No decayed or fermented fruit or vegetables, cider mill wastes, roots, grain or other vegetable refuse of any kind shall be thrown, placed, discharged

or allowed to escape or pass into any reservoir or watercourse, nor shall they be thrown, placed, piled, maintained or allowed to remain in such places that the drainage, leachings or washings therefrom may flow by open, blind or covered drains or channels of any kind into any reservoir or watercourse without first having passed over or through such an extent of soil as to have been properly purified, and in no case shall it be deemed that sufficient purification has been secured unless the above mentioned drainings, leachings or washings shall have percolated over or through the soil in a scattered, dissipated form, and not concentrated in perceptible lines of drainage, for a distance of not less than one hundred and fifty (150) feet before entering any reservoir or watercourse tributary to the public water supply furnished by the Sylvan Spring Water Company.

Dead Animals, Offal, Manufacturing Waste, Etc.

14. No dead animals, bird, fish, or any part thereof, nor any offal or waste matter of any kind, shall be thrown, placed, discharged or allowed to escape or to pass into any reservoir, or watercourse, nor shall any such material or refuse be so located, placed, maintained or allowed to remain that the drainage, leachings or washings therefrom may reach any such reservoir or watercourse without having first percolated over or through the soil in a scattered, dissipated form and not concentrated in perceptible lines of drainage, for a distance of two hundred and fifty (250) feet from any reservoir or watercourse tributary to the public water supply furnished by the Sylvan Spring Water Company.

Fishing, Boating and Ice Cutting

15. No boating of any kind, or fishing from boats, or through the ice, or any trespassing whatever shall be allowed in or upon the waters or ice of the reservoirs except by written permission and in strict compliance with the regulations to be adopted by the Sylvan Spring Water Company, nor in any manner that may pollute the waters of this public water supply. All ice cutting shall be done under rigid inspection and supervision of the Sylvan Spring Water Company.

16. No temporary camp, tent, building or other structure for housing laborers engaged on construction work or for other purposes shall be located, placed or maintained within a distance of five hundred (500) feet from any reservoir or watercourse tributary to the public water supply furnished by the Sylvan Spring Water Company.

Cemeteries

17. No interment of a human body shall be made within a distance of three hundred (300) feet from any reservoir or from any watercourse tributary to the public water supply furnished by the Sylvan Spring Water Company.

18. The Sylvan Spring Water Company shall make regular and thorough inspections of the reservoirs, streams and drainage areas tributary thereto for the purpose of ascertaining whether the above rules and regulations are being complied with, and it shall be the duty of said Sylvan Spring Water Company to cause copies of any rules and regulations violated to be served upon the persons violating the same with notices of such violation; and if such persons served do not immediately comply with the rules and regulations, it shall be the further duty of the Sylvan Spring Water Company to promptly notify the State Commissioner of Health of such violations. The Sylvan Spring Water Company shall report in writing annually on the first of January, the results of the regular inspections made during the preceding year, stating the number of inspections which have been made, the number of violations found, the number of notices served, and the general condition of the watershed at the time of the last inspection.

Penalty

19. In accordance with section 70 of chapter 45 of the Consolidated Laws (Public Health Law), the penalty for each and every violation of, or non-compliance with, any of these rules and regulations which relate to a

permanent source or act of contamination, is hereby fixed at one hundred (100) dollars.

The foregoing rules and regulations for the protection from contamination of the public water supply furnished by the Sylvan Spring Water Company to the village of Sylvan Beach and other nearby communities are hereby duly made, ordained and established on this 21st day of January, 1915, pursuant to chapter 45 of the Consolidated Laws (Public Health Law) of the State of New York, as amended by chapter 695 of the Laws of 1911.

HERMANN M. BIGGS,
ALBANY, N. Y. *State Commissioner of Health*

These rules and regulations to be operative and valid must first be published at least once each week for six consecutive weeks in at least one newspaper in Oneida county, and the affidavit of the printer, publisher or proprietor of each newspaper in which such publication is made, that the publication was so made, together with a copy of the rules and regulations, must be filed with the county clerk of that county.

The cost of each such publication, affidavit and filing must be paid by the Sylvan Spring Water Company.

INSPECTIONS OF VIOLATIONS OF RULES FOR THE PROTECTION OF PUBLIC WATER SUPPLIES

During 1915, inspections of violations of the rules and regulations were made and the necessary orders to local boards of health, issued in connection with the water supplies of the following municipalities: Central Valley and Highland Mills, Cornell University, Kingston, Monticello, Mount Vernon and Nyack.

ISSUANCE OF GENERAL ORDER FOR VIOLATIONS OF WATER SUPPLY RULES

Under section 71 of the Public Health Law, a general order was issued in December, 1912, requiring local officials in charge of the water supplies for which rules and regulations had been enacted to report in writing on the first day of January of each year the detailed results of the regular inspections of the water supply and the steps taken to abate any violations found. All rules enacted since 1912 have contained a similar requirement.

Upon receipt, the reports of these water works officials are carefully reviewed and in cases where violations are reported as existing, the Engineering Division takes the necessary action for the abatement of such violations.

INVESTIGATION OF COMPLAINTS RELATING TO STREAM POLLUTION

INVESTIGATION OF COMPLAINTS RELATING TO STREAM POLLUTION

The pollution of the watercourses of the State is a matter affecting very closely the health of the people. With the increase of population and consequent increase in volume of sewage discharged into the watercourses of the State from municipalities and with the increase in manufacturing establishments from which wastes of widely varying kinds are discharged, the pollution of the streams tends always to become greater. Conversely, the greater demand upon the streams to supply water to the increased populations and its more extensive use for manufacturing and agricultural purposes requires that the purity of the water shall be carefully protected.

This Department, acting under provisions of the Public Health Law, is frequently called upon to investigate and prepare a report of cases of the pollution of streams and where necessary to take further legal action toward preventing the pollution of streams to the detriment of the public health.

The reports upon the more important of such cases which came before this Department during 1915 are given below and a list is also appended of all other cases.

COOPERSTOWN

HERMANN M. BIGGS, M. D., *State Commissioner of Health:*

I beg to submit the following report of an investigation made of the pollution of the Susquehanna river by the discharge of sewage from the village of Cooperstown in Otsego county. This investigation was made on August 24 and 25, 1914, by Mr. Morton F. Sanborn, assistant engineer, as a result of complaints of the pollution which have been made in the past.

General description

Cooperstown is an incorporated village and is located at the lower end of Otsego lake on the headwaters of the Susquehanna river. It is the terminal of the Cooperstown and Oneonta branch of the D. & H. R. R. and the O. & H. electric R. R. has a branch line to Cooperstown. It is largely a residential village although it has a few industries of which the largest is the International Milk Products Company. Cooperstown, and especially Otsego lake are well known as summer resorts. The population of Cooperstown has increased slowly, there being 2,446 people in 1905 and 2,484 in 1910, while the present population was estimated as about 2,900 with 500 additional during the summer. The village is about 1,260 feet above sea level and from 20 to 60 feet above the water of the lake. The banks of the Susquehanna river as it flows past the village are from 20 to 60 feet high and

as the river passes the dam at Cooperstown there is a fall of about 10 feet in the level of the water of the river. Hop growing is carried on to quite an extent in the surrounding country.

The unincorporated village of Phoenix Mills with about 100 population is located on the river 2½ miles below Cooperstown and about 5½ miles further down is the village of Milford having a population of 510. About 5 miles below Milford is the unincorporated village of Portlandville having a population of 150. On the Susquehanna river below Portlandville is located a large reservoir which furnishes water power for a large hydro-electric plant.

The public water supply of Cooperstown is furnished from Otsego lake by the Cooperstown Aqueduct Association. This water is taken from a point about 1,500 feet up the lake from the outlet and is pumped into the mains and reservoir and used without filtration. The average total consumption as determined at the pumping plant was about 900,000 gallons per day, with the night rate of pumping about two-thirds of that of the day. The engineer stated that he thought a large part of the water pumped was wasted on account of leaky mains and pipes. Assuming an average consumption per capita of 100 gallons together with the 100,000 gallons used at the creamery would give about 440,000 gallons as the legitimate consumption per day and the balance of 460,000 gallons per day, which is about one-half of the total pumpage, is probably wasted through the leaky mains and pipes. About 95 per cent. of the inhabitants are served by the water company and the total average daily consumption per person using the water, including that used by the creamery and the leakage would be about 280 gallons per capita.

The sewer system of the village consists of about 10 miles of sanitary sewers ranging in size from 6 inches to 12 inches and the various sewers discharge through three outlets into the Susquehanna river. The main sewer serves the greater part of the village and extends along the lake front and down the river, discharging about 300 feet below the dam, at the junction of the main river with the tailrace from the water works station. The next outlet discharges into the river at Susquehanna Street Bridge and receives sewage from about one-third of the village. The lower outlet is from the Delaware Street District and no sewage could be noticed flowing from this outlet at the time of the inspection.

The sewers are chiefly 8 inches in diameter, although the portions adjacent to the outlets are of 12-inch pipe. The capacity of the main sewer is not sufficient to carry off all the sewage that reaches it, so an overflow was built allowing the excess sewage to flow into the lake near the entrance to the river, thus relieving the upper parts of the sewer system in this district.

The approximate amount of sewage flowing at the time of the inspection was about 600,000 gallons per day as determined by measurements taken in the main sewer near the outlet. As practically all of the population is served by the sewers the per capita flow of sewage would amount to about 177 gallons per day of which about 30 gallons per capita are received from the creamery.

The plant of the International Milk Products Company is located near the railroad station in Cooperstown. This company is engaged in the shipment of milk and the manufacture of ice cream, cheese and other by-products of milk. They use from 100,000 to 125,000 gallons of water per day of which about 30,000 gallons are taken from their own wells. The wastes from this plant are discharged into the village sewer system and consist largely of condenser water, wash water, cheese, whey and other wastes and at times may be highly organic in character.

Review of events leading to the present investigation

Previous to 1894 most of the sewage from the village flowed directly into the lake and since the public water supply was obtained from a point about 1,200 feet up the lake it was thought that the pollution of the lake water caused by the discharge of this sewage might have some effect in causing typhoid fever in the village. Plans were approved September 18, 1895, for

the extension of the sewer system and for the discharge of the sewage below the dam at the water works station.

As the main sewer proved to be inadequate to carry the amount of sewage contributed to it plans were approved in 1896 for increasing the size of this sewer from the lake front to the outfall but this improvement was never carried out. In 1900 plans providing for sewers in the Delaware Street district were approved and in 1911 plans for a small extension of the Susquehanna Street district were approved.

At various times during the past few years plans have been submitted for extensions of the sewer system, but since the plans did not fulfill the requirements and show a comprehensive system of sewers including plans for disposal works the plans were returned with the request for additional information and the corrected plans were never resubmitted for approval.

In the report on an investigation of the prevalence of typhoid fever at Cooperstown made by the chief engineer in 1909, it was pointed out that the maintenance of both the main sewer and intake water pipe in the bed of the river made a rather questionable condition for the public water supply.

Complaints have been received in the past from Phoenix Mills and Milford in regard to the pollution of the river and these complaints have arisen at times of low flow, when practically no water was being used for water power.

Flow of river at Cooperstown

Water flowing into Otsego lake finds an outlet in the Susquehanna river on which is located a dam about one-eighth mile from the lake. The level of the water in the lake is maintained at any desired elevation by means of flash boards on the dam. At this dam is located the pumping station for the public water supply and the pumps are operated by water power whenever this power is available and at other times by steam power. The river has a drainage area above the dam of approximately 82 square miles consisting mostly of hilly and woody areas with the low lands open and used for cultivation or for the pasturing of cattle.

The lake does not receive sewage or other wastes except as above noted at the overflow and possibly from cottages located on the shores of the lake. Below Cooperstown the river water is not used for public water supply for many miles and the river receives but little sewage as far as Oneonta by which time the river has increased considerably in size.

At the time of the inspection the water in the lake was 11 inches above the crest of the dam and 13 inches below the top of the flash boards placed on the dam. The following conditions of flow were observed at the inspection and these conditions were stated to have been the same for part of the summer: The water pumping station was being operated by steam from 7 A. M. to 5 P. M. and by water power from 6 P. M. to 7 A. M. The flow during the period when the water wheels were not running amounted to about 1½ cubic feet per second and was due to leakage through the dam and water works. The flow while the wheels were running as obtained by current meter measurements was about 62 cubic feet per second or .41 cubic feet per second per square mile. This rate is somewhat high for the average low flow but previous to the inspection considerable rain had fallen.

The average low flow would probably be about .2 cubic feet per second per square mile and during the fall of 1908, which was an exceptionally dry period, the average flow at Collins which is about 15 miles below Cooperstown, was .057 cubic feet per second per square mile from September 7 to September 30; .11 cubic feet per second per square mile during October; .37 cubic feet per second per square mile for November and for December the average flow was .093 cubic feet per second per square mile. This gave an average of .084 cubic feet per second per square mile for the four months and is a very low record.

With an average flow of .1 cubic feet per second per square mile the total flow past Cooperstown would be 8.2 cubic feet per second which is considerably smaller than the amount necessary to properly care for the sewage of from 3,000 to 3,500 people during the summer. Also the use of the water for

pumping causes an intermittent flow and for a considerable period of time during the fall of 1908 no water was allowed to flow from the lake. This condition was obtained as the result of using for a time too much of the water for power purposes which lowered the lake considerably and by this period being followed by a season of very low runoff on the watershed.

General condition of lake and river

At the overflow in the main sanitary sewer on the lake near the entrance to the Susquehanna river a small amount of sewage was overflowing into the lake during the greater part of the day. The point of discharge from this overflow is about 3 feet above the lake level. Below the discharge of the sewage on the shore of the lake considerable paper and fecal matter had lodged on the stones and was exposed to the air forming a breeding place for flies and was in full view of persons passing through the park.

The lake water as it received the overflowing sewage became a dirty gray color which was very pronounced for about 100 feet from the outlet. Beyond this point the color or turbidity, due to the sewage, gradually became less at points further distant from the overflow until, at a distance of 500 or 600 feet, traces of the sewage could barely be seen.

The sewage overflowing into the lake is a potential source of danger to the village since the public water supply is taken from a point about 1,500 feet up the lake and the water is used without purification. A wind blowing up the lake might cause serious sickness in the village due to the contamination of the water from the sewage.

Also a part of the water intake pipe is laid upon the bed of the river from the lake to the pumping station and the pipe must necessarily be under a vacuum condition during pumping of the water. Therefore, any sewage overflowing into the lake or leaking from the main sewer, which is also laid in the bed of the river and which for part of the distance has a pressure from within greater than that from without, would mix with the river water and in the event of any open air valves or leaks in the water main the water of the village would be seriously contaminated. In the reconstruction of the intercepting sewer provision should be made in the location to keep the sewer at a sufficient distance from the river water, above the dam, and to have it of sufficient size to prevent the sewage from flowing under a head.

General description of the condition of the river at the time of inspection with statement as to condition of flow

At the time of the inspection the temperature was about 70°, the wind being from the west with a velocity of about 3 miles per hour, and the humidity was low.

The river below the water works pumping station flows through low land with fairly high banks and there are no houses near the river except at Susquehanna street where the nearest house is about 400 feet away. At places the banks have been used for dumping rubbish and present a very unsightly appearance.

The water company that furnishes the public water supply to the village was using steam power from 7 A. M. to 6 P. M. and water power from 6 P. M. to 7 A. M. to pump the water into the distributing system. The operation of the water power plant during the night resulted in an average flow in the river during the night time of about 62 cubic feet per second, but through the day, when the water power plant was not in operation, this flow was reduced to about 1½ cubic feet per second. During the period of high flow the water power is used for 24 hours and during some of the dryest years no water is used for days at a time when the lake water is at its lowest point.

This condition of alternating between very little flow during the day and considerable flow at night produces a condition, for about a mile below the water works, similar to that which would result from the discharge of sewage into a large settling tank during the day which is flushed out every

night with a larger flow. In this manner the sludge is deposited further down the river in the deeper portions. Dissolved oxygen was found to be present in all the samples tested, although the amount was found to be as low as 1.2 parts in the sample taken in the afternoon about 300 feet below the Susquehanna street outlet. The water in the river below the outlets appeared a little darker in the afternoon than in the morning. About one-half mile below the Susquehanna street outlet, in a sluggish portion of the river, bubbles of gas could be seen rising, due to the putrifying action of the sludge lying on the bottom of the river. The discharge of sewage into the river at times, when the waterwheels are not in operation, also results in a deposit of sludge in the bed of the river, especially in the deeper places and places protected from the direct current. The bed of the river was covered with this sludge or sewage fungi growths, and part of it was exposed during the day and gave off disagreeable odors. It was also stated by people who work near the river below Susquehanna street that at times there is a very strong odor of sour milk which was due to the wastes from the creamery.

A very few small fish were noticed in the stream near the sewer outlet at Susquehanna street bridge.

As the waterwheels are started in the evening the water level in the river below the dam rises, causing the sewage from the main outlet to back up the river toward the dam, resulting in very foul conditions in the section of the river extending 400 or 500 feet back to the dam. In the morning when the wheels are stopped the clearer portion of this sewage is gradually drawn off and part of the sludge which had settled is exposed during the day.

In order to determine the actual conditions of the sewage and of the river water above the sewer outlets analyses were made of the sewage and river water above the outlets and of the river water at several places below the outlets. These analyses included the temperatures of the samples and tests for turbidity, oxygen consumed, dissolved oxygen, chlorine and putrescibility and the results are shown in the following table.

While the results of but one set of analyses may not represent the average condition of the sewage and of the lake and river water, they do, nevertheless, show the condition at the time of inspection which may be stated as follows:

The lake water, one-sixth mile west of the outlet, was clear and nonputrescible. It had 3.3 parts of oxygen consumed, 4.8 parts of dissolved oxygen, a trace of nitrates and 3 parts of chlorine. These tests indicate a water at the point of sampling on the day of inspection apparently free from pollution.

Results of Analyses of Sewage of the Lake Water and of the River Water Below the Outlets Taken on August 25, 1914

LOCATION	Time taken	Temperature	PARTS PER MILLION					Putrescibility, days
			Turbidity	Oxygen consumed 10 min. boiling	Dissolved oxygen	Nitrates	Chlorine	
Lake, one-quarter mile west of outlet	9:30 A. M.	68°	Clear	3.3	4.8	Trace	3	20+
Sewage overflowing into lake	10:00 A. M.	......	....	120	....	....	200	....
River below first outlet	10:00 A. M.	68°	17	32	3.2	....	25	2.1
River, 300 feet below Susquehanna street	5:30 P. M.	......	....	32	1.2	....	50	1
River, one-half mile below Susquehanna st.	8:30 A. M.	64°	....	35	3.5	....	5	20+
Same as above	4:15 P. M.	......	....	15	5.25	....	7	20+
River, three-fourths mile above Phoenix Mills	3:00 P. M.	68°	Under 10	13.5	4.4	....	....	20+
River above dam at Phoenix Mills	2:50 P. M.	68°	Under 7	17	4.0	....	14	20+

The raw sewage, as determined by the oxygen consumed test, was about 20 per cent. stronger than the day-flow of the average domestic sewage of a municipality of this size. The strength, as shown by the chlorine test, was about 100 per cent. stronger than the average domestic sewage. These high results are probably due to the wastes from the creamery.

The river water below the two principal outlets had 32 parts of oxygen consumed and in the chlorine test 25 to 50 parts were found. The turbidity of the stream had 17 parts, as against the clear water of the lake. The river water below the upper outlet contained 3.2 parts of dissolved oxygen, and the water below the second outlet in the afternoon had only 1.2 parts and plainly illustrates the reduction of dissolved oxygen due to bacterial action. The samples taken 300 feet below the second outlet were putrescible in ⅔ of a day, and the sample taken below the first outlet was putrescible in 2.1 days. These tests show that if it were not for the night flush of clear water the river would be in a condition comparable to an open septic tank in one or two days.

The tests of the water in the river from ½ mile below Susquehanna street to the dam at Phœnix Mills showed the effect of the greater dilution of the day-flow just below the outlets. The oxygen consumed gave about 15 parts, except one test, which gave 35 parts. The dissolved oxygen varied from 3.5 to 5.25 parts, and compared favorably with the dissolved oxygen in the lake water. The chlorine varied from 5 parts to 14 parts, as compared with the 3 parts contained in the lake water, and indicated polluted water. The samples were not putrescible, as the dilution was sufficient to care for the sewage during the night flow.

Summary and conclusions

As a result of this investigation, and after a careful consideration of the conditions of the stream above and below the points of pollution and of the amount of flow to properly care for the quantity of sewage and other wastes discharging into the river, the following summary and conclusions are presented:

1. That the sewage overflowing to the lake from the sanitary sewers causes a serious menace to the quality of the public water supply.
2. That the paper and fecal matter deposited on the shore of the lake at the overflow, besides forming a breeding place for flies and constituting a menace to public health, renders conditions at this point very obnoxious and objectionable.
3. That the flow of the Susquehanna river at Cooperstown is not sufficient to afford adequate dilution for the quantity of sewage discharged from the sewer system of the village to prevent the creation of a nuisance during the summer season and at other times of low flow in the stream.
4. That any condition of nuisance is augmented by the intermittent operation of the waterwheels, since a greater part of the sewage remains in the river near the village during the day, and at night the sewage and sludge are flushed down the river, and, furthermore, that this sludge is again deposited in the more sluggish parts of the river as far as Phoenix Mills.
5. That there are occasional periods when water from the lake is not being used for power, but is stored in the lake on account of drought, and at such times putrefactive conditions are set up in the river below the dam and along the river for several miles below, thus affecting, not only the village of Cooperstown, but other municipalities situated below.
6. As a result, therefore, of the discharge of sewage from the village of Cooperstown in the lake a serious menace to the quality of the water supply furnished to the village is present at all times.
7. As a result of the discharge of untreated sewage from the village into the river; of the insufficient dilution of this sewage in the river; of the fluctuation of flow in the river, and of the fact that occasionally, for

several days at a time, there is practically no flow in the river below the dam, a public nuisance is created in and along the river which affects not only the village of Cooperstown, but other villages and riparian owners along the river below Cooperstown.

Recommendations

That, in view of the above, I would recommend that the village of Cooperstown be required to construct, within a reasonable time, proper sewage disposal works to treat the sanitary sewage of the village, and that the village be requested to submit at an early date, for the approval of this Department, satisfactory plans for such sewage disposal works.

I would also recommend that the village authorities be required to submit, as soon as possible, plans for that part of the sewer system which will prevent the overflow of any sewage into the lake or river above the dam, in order that this sewer may be constructed and in operation that temporary sterilization of all sewage overflowing into the lake be provided for.

I would further recommend that the attention of the village be called to the provision of section 76-a of the Public Health Law, and that they be advised that it is the intention of this Department to take action under said section if, within a reasonable time, steps are not taken by the village to provide for proper treatment of the sewage now being discharged from the sewer system of the village into Otsego lake and Susquehanna river.

Respectfully submitted,

THEODORE HORTON,

Chief Engineer

ALBANY, N. Y., *June* 11, 1915

A copy of this report was transmitted to the village authorities on June 15, 1915, and as a result of this report the board of trustees submitted plans on August 9, 1915, for an improved sewer system and partial treatment of the sewage.

CORTLAND

HERMANN M. BIGGS, M. D., *State Commissioner of Health:*

I beg to submit the following report on an investigation made of the pollution of the Tioughnioga river at Cortland by the sewage of the city of Cortland in Cortland county, and of the character and effect of the pollution of this river due to the discharge therein of wastes from the wire plant of Wickwire Brothers. Following the recent complaints made to this Department, this investigation was undertaken on August 26, 27, 28, 1914, by Mr. Morton F. Sanborn, assistant engineer, in order to determine the amount and character of the pollution.

Review of events leading to the present investigation

Cortland, a city of about 12,500 inhabitants and located at the junction of the east and west branches of the Tioughnioga river, has been discharging its sewage into the river without any treatment for over twenty years. Considerable trade wastes are also included in the sewage, some of which are of sufficient quantity to materially affect the character of the sewage.

Plans for the systems of sewerage and sewage disposal for the city were submitted and approved by this Department on October 27, 1892. It was proposed by these plans to treat the sewage by chemical precipitation, using lime and sulphate of aluminum. In 1892 it was thought that in ten years the population would have increased enough to require the construction of the disposal works, as the capacity of the river to properly care for the

sewage during the summer would be about reached. In 1894 the main sewer outlet was extended down the river about a mile. In 1906 suit was brought by the owner of the mill at Blodgett Mills against the city of Cortland and he received an award of $600. In 1907 complaints were received by the State Department of Health in regard to the pollution of the river by the city of Cortland and by Wickwire Brothers from their wire plant. Additional complaints have been received at various times up to the present. In 1907 and 1908 Wickwire Brothers installed a recovering plant to treat the iron sulphate and recover it in crystalized form. It was thought that this would largely remove their pollution from the river. In 1910, due to additional complaints, an inspection was made and as a result it was recommended that the city of Cortland provide for proper treatment of its sewage. (Annual Report, No. 31, p. 638.) The present investigation was made to determine the amount and character of the pollution and to recommend action to be taken to provide for an abatement of the nuisance due to the discharge of sewage.

General description

The city of Cortland is located on the Tioughnioga river at the junction of the east and west branches of the river. The city is fairly level and is built on the plains in the river valley. The population of the city has increased slowly and steadily, it being 11,272 in 1905 and 11,504 in 1910, while the present population is estimated at about 12,500. Branches of the Lehigh Valley railroad and the Delaware, Lackawanna and Western railroad pass through the city, while the Erie and Central New York railroad has a terminal in Cortland. There are several manufacturing establishments located in Cortland, by far the largest of which is the wire plant of Wickwire Brothers, employing over 1,500 persons.

Located about 3 miles below Cortland is the small unincorporated village of Blodgett Mills, which has a population of about 150. About 9 miles below Cortland is the small unincorporated village of Messengerville, with a population of about 100, and about 13 miles below Cortland is the village of Marathon, with a population of about 1,100. Complaints have been received in regard to the Cortland sewage as far down the river as Marathon.

The water supply of the city is furnished by the municipality from springs in the western part of the city and is pumped directly to the mains and to the standpipe on the hill. This supply is not filtered and serves about 95 per cent. of the people of the city. The average daily consumption for July, 1914, was 1,160,000 gallons, which corresponds to a daily consumption per capita of about 98 gallons.

There are about 14 miles of sanitary sewers, ranging in size from 6 inches to 24 inches, and serving about 95 per cent. of the people in the city. Several of the sewers flow under a head as they are below the level of the water in the river, and at times of high flow the level of the sewage in the sewers rises and at these times might cause considerable trouble by the backing up of the sewage into the cellars. There is only one sewer outlet and this outlet is located about one mile below Port Watson street bridge. The outlet consists of a 24-inch cast-iron outfall pipe with the top of the open and about 8 inches under water and about 30 feet from the westerly bank of the river. From this outlet all of the sewage and trade wastes of the city are discharged.

The city engineer stated that the flow was about 7,000,000 gallons per day, of which a large percentage was ground water, and that about 1,000,000 gallons per day were received from the plant of Wickwire Brothers. Meter readings, taken at the time of inspection, gave a flow of about 6,200,000 gallons per day. Deducting the flow received from Wickwire Brothers, would give a flow of 5,200,000 gallons per day, which is equal to a flow of about 438 gallons per capita per day. Comparing this flow per capita with the average daily water consumption per capita of 98 gallons, it is very evident that a large part of the flow in the sewers is due to ground water.

Manufacturing establishments whose trade wastes have more or less effect upon the question of stream pollution at Cortland since they contribute to the volume of sewage

1. *Wickwire Brothers*, manufacturers of wire and wire goods. The flow from this plant is estimated at about 1,000,000 gallons per day and contains considerable amounts of iron sulphate, which, uniting with the lime and oxygen in the river water gives a red-brown precipitate. This precipitate settles in the deeper portions of the river and probably carries down with it considerable of the suspended matter of the sewage. From the records obtained at the factory of the amounts of acid received and of iron sulphate recovered during the past year it would appear that there was an average of 5.7 tons of acid used per day which were not recovered, and part of this found its way to the river as copperas in the sewage.

2. *Egenbury Milk Products Company.*— The creamery is located in the southern part of Cortland and in it are manufactured the byproducts of milk. Their water supply is obtained from a private source. Wastes from this factory contain considerable condensing water and wash water, are not very heavy and probably do not affect materially the waters of the river.

3. *Wallace Wall Paper Company*, located in the city, do the printing on wall papers. They use about 10,000 gallons of water per day, chiefly for the washing of the printing machines. These wastes are at times highly colored and may be either slightly alkaline or acid.

4. *A. H. Winchall and Company* and the *Cortland Beef Company* are located in the same building, near the railroad, and have to do with the slaughtering and selling of beef and other meats. Their combined wastes vary from 20,000 to 25,000 gallons per day and are probably highly organic in character.

The flow of the river at Cortland

The Tioughnioga river, which flows past Cortland, has a drainage area above this point of approximately 267 square miles, of which 103 square miles are in the west branch and 164 square miles in the east branch. The land drained consists mainly of hilly country, with fairly broad level valleys through which the river flows. There are some low dams on the west branch at Cortland, but they do not store much water and, therefore, do not materially affect the flow past the outlet sewer. Above this outlet the river receives very little sewage or trade wastes and below Cortland it is not used for water supply or sewage disposal for many miles.

The flow of the river, as measured by current meter at the trolley bridge on August 26, 1914, was 236 cubic feet per second. This gives a rate of .88 cubic feet per second per square mile. Considerable rain had fallen previous to the inspection, and from two sources of information it was found that the average dry weather flow was estimated at about one-third of the flow obtained on August 26. This average dry weather flow would, therefore, be 79 cubic feet per second, and is about .3 cubic feet per second per square mile. From the records of the Chenango river at Binghamton, and of other rivers in the southern part of New York State, it is estimated that the minimum flow is about .1 cubic foot per second per square mile, or even lower.

At this rate of .1 cubic foot per second per square mile the total flow under minimum conditions would be about 27 cubic feet per second, and considering that a flow of 5 cubic feet per second would care for the sewage of 1,000 people without causing a nuisance, it can be readily seen that the sewage of only 5,500 people could probably be taken care of, while for the 12,500 people in Cortland there would be required a flow of about 72½ cubic feet per second or more. This does not make any allowance for the trade wastes of the city, so that even with a flow of 72½ cubic feet per second a nuisance might be created. There is a comparatively small amount of additional dilution before the river reaches Blodgett Mills, due to the waters of Trout brook.

Description of pickling wastes and copperas recovering plant at Wickwire Brothers

Dilute sulphuric acid is used to clean the wire of impurities so that it can be coated as required in the manufacturing of the wire goods. The wire is placed in this acid solution several times from the beginning of the rolling to the finished product to remove rust or other foreign matter on the wire. This acid bath leaves the wire in a bright condition so that it may be coated with lime or other material to assist in the rolling and to prepare it for the final treatment. This bath is about a 9 per cent. solution and is used until its strength is reduced to 1 or 2 per cent., beyond which it is not economical for use and it is then discharged into a large vat where any suspended matter will settle out. The lime used in coating the wire is removed in the acid bath and this lime probably acts to neutralize the acid and form a precipitate which settles out in the large vat. From this vat the copperas, containing some free acid, is drawn to a larger vat containing baffles and old pieces of rusty iron which further neutralizes the acid and changes it to iron sulphate. This solution is then pumped to large evaporating kettles, where its specific gravity is increased by evaporation so that the copperas will readily crystalize. After reaching a certain specific gravity it is then run into iron tanks containing round iron plungers. The copperas in the solution crystalizes on the plungers' sides and bottom of the tank until the specific gravity of the solution has been sufficiently reduced and the remaining liquid is again boiled down and more copperas is recovered as before. The copperas which forms on the plungers is crystaline in character and of the best grade, while that formed on the sides and bottom is granular in form and is not of as good grade.

Effect of iron wastes from the wire plant of Wickwire Brothers on the sewage and on the waters of the river

At the office of Wickwire Bros. it was stated that during the past year 2,800 tons of sulphuric acid were used at the plant and 2,060 tons of copperas were recovered. 2,060 tons of copperas containing the water of crystalization ($Fe\ SO_4 + 7\ H_2O$) would require 726 tons of acid in its production. This leaves a balance of 2,074 tons of acid used which was not recovered and part of which was probably converted into calcium sulphate and part found its way into the sewer and then to the river as iron sulphate. This would be equivalent to 5.7 tons of acid a day which was not recovered as copperas. The figures for copperas recovered and the appearance of the river for 3 or 4 miles below the outlet show that there is still considerable waste of the copperas. The inspection of the copperas recovering plant seemed to indicate an efficient method and consequently it is not quite clear how so much of the acid escapes, although there is considerable leakage from the tanks and the water used in washing the wire and the drainage from the floors all flow into the sewer.

The sewage did not contain any free sulphuric acid and the river water had 114 parts per million of alkalinity. This alkalinity is more than enough to precipitate the iron sulphate even at periods of low flow. This copperas in the sewage combining with the lime in the river water forms a precipitate which gradually turns red as it becomes oxidized and settles to the bottom of the river. This precipitate apparently carries down most of the suspended matter depositing part of it in deep water lower down, both above and below the dam at Blodgett Mills so that still further down the river the water was clearer in appearance with very little indication of the red-brown color. Accumulation of sludge in the still or deeper water above the dam was indicated by gas bubbles apparently arising from decomposing sludge on the bottom of the river.

In the event of construction of works for the treatment of the sewage of Cortland and if the iron wastes as they are at present discharged into the sewers are to be treated with the sewage, then chemical precipitation might with considerable economy, be provided for as part of the treatment. The addition of lime combining with the copperas in the sewage will give a precipitate that will settle and carry with it a greater part of the suspended matter. If this iron is not removed by the addition of lime then it is likely to be precipitated in any filters which might be constructed, and clog them up, or it will be precipitated in the river as at present and cause the river water to become red-brown due to the iron oxide formed. If the trade wastes were to be treated by the company, then the settled water of the iron wastes might be discharged into the river directly and the city sewage might then be treated by any of the well known methods of sewage disposal.

General conditions of the river

For a short time in the afternoon of the 29th the sewage emerging from the outlet was red-brown in color. The rest of the time the sewage was of a dirty white color and discolored the river water so as to show a marked line of flow as it swept on down the river. As the sewage emerged from the outlet the outside threads of flow of the sewage turned red-brown in color at once showing the formation of iron oxides due to the copperas in the sewage and the lime and oxygen in the river water. The discoloration in the river gradually became wider until about one-half mile down it took up approximately the western half of the river and the color had nearly all changed to red-brown. At a point about 1¼ miles below the outlet due to further mixing of the water caused by bends and slight rapids in the river the discoloration extended clear across the river, the original color of the sewage had disappeared and instead it was of a red-brown color while the iron oxide could plainly be seen suspended in the water. This red-brown color extended some distance below Blodgett Mills and about 2 or 3 miles below the dam the water apparently started to resume its normal conditions. From 6 to 8 miles below the dam very little of the red-brown color could be detected in the water.

A much more luxuriant growth of eel grass could be noted in that portion of the river colored by the sewage than that on the other side of the river and down by the dam a considerable portion of the surface of the water was covered by the grass. No very bad odors were detected at the time of the inspection during which there was a slight breeze with wind from the west, the humidity was low and the barometer stood at about 30.2 inches. Some of the people seen at Blodgett Mills said that the odors on a close evening were very bad, while others stated that they did not notice the odors.

No fish were seen in the river except above the sewer outlet. Although some fishing is done below this outlet no evidence was obtained as to the amount or kinds of fish caught. Numerous children were noticed bathing in the river above the sewer outlet where the water was generally about three feet deep, although at the swimming pools there was enough depth of water for the use of a spring board in diving.

In order to determine the actual condition of the sewage and of the river water above and below the sewer outlet analyses were made of the sewage and river water. This analysis included the temperature of the sample and tests of the turbidity, oxygen consumed, dissolved oxygen, chlorine, putrescibility, the amount of settling in an Imhoff cone and the number of bacteria in the sewage, and the results are shown in the following table:

Results of analyses of sewage and river water above and below sewer outlet taken on August 27, 1914

LOCATION	Time	Temperature	Parts Per Million						Putrescibility days	Bacteria 20° Agar.
			Turbidity	Oxygen consumed 10 min. boiling	Dissolved Oxygen		Chlorine			
					Parts	Per cent of saturation				
River water above outlet..........	11:00 A. M.	68	Clear	3.85	5.3	58%	5		20	0
Sewage from outlet.	11:30 A. M.	61	200	79	0.0	6%	......		1	310,000
1½ mile below outlet	10:00 A. M.	68	35	18.5	3.7	40%	6		20	....
Just above dam at Blodgett Mills...	9:00 A. M.	68	Under 10	18	3.2	35%	6		20	....

In the Imhoff settling cone 1,000 cubic centimeters of the raw sewage gave 1.8 cubic centimeters of sludge in 10 minutes, 5.5 cubic centimeters in 1 hour, 7.5 cubic centimeters in 2¾ hours and 7.5 cubic centimeters in 4 hours, while in 198 cubic centimeters of sewage to which 102 cubic centimeters of lime water had been added gave 5 cubic centimeters in 7½ minutes and 6.5 cubic centimeters in 15 minutes after which the sludge settled and became compacted and was reduced to 4.2 cubic centimeters in 5 hours giving a fairly clear liquid while that of the untreated sewage was still quite turbid.

While one set of analyses cannot be considered as showing the average conditions of the sewage and of the river water above and below the sewer outlet, yet they showed the conditions at the time of inspection which were as follows:

The raw sewage was somewhat weak as indicated by the ogygen consumed test it being only about 75 per cent. as strong as the average sewage of the day flow. This may be accounted for by the excess amount of ground water entering the sewers. In the turbidity test the raw sewage had 200 parts while 1½ miles below the outlet the river water had changed from a clear water to one having 35 parts per million. This increase in turbidity in the river water is not due alone to the turbidity found in the sewage of 200 parts as the amount of sewage flowing at the time of inspection diluted by the river water would give but 4 parts, but is due chiefly to the precipitate found upon the combining of the copperas in the sewage and the lime in the river water. The turbidity of the river water above the dam was reduced by sedimentation to under 10 parts. The oxygen consumed of the river water below the sewer outlet was quite high and probably represents organic matter and ferrous iron.

In the dissolved oxygen tests the sample taken 1¼ miles below the sewer outfall gave a reduction of 30 per cent. from that in the river water above the sewer outfall and the sample taken just above the dam gave a reduction of 40 per cent.

In the putrescibility test the raw sewage stood up one day while the samples of river water above and below the outfall stood up over 20 days.

An average of two samples of the sewage which were plated after the sewage had been standing two days gave 310,000 bacteria per cubic centimeter which is rather low for a weak sewage standing 2 days and may indicate a slight germicidal effect due to the copperas in the sewage.

Summary and conclusions

As a result of this investigation and after a careful consideration of the conditions of the stream above and below the points of pollution and of the amount of flow with respect to its capacity to properly care for the quantity of sewage and other wastes discharged into the river, the following summary and conclusions are presented:

1. That owing to the large amount of domestic sewage and trade wastes discharged into the Tioughnioga river and to the comparatively limited flow of the river at certain seasons of the year, a condition of nuisance in the river is set up as evidenced by the sludge deposits on the bed of the stream and the offensive odors given off.
2. That the chemical wastes discharged from the wire plant of Wickwire Brothers into the sewer system has intensified the effect of the pollution of the river a short distance below the outfall through the action of the chemicals contained in these trade wastes in precipitating the suspended matter contained in the domestic sewage.
3. That owing to the nature of the chemicals contained in the wastes discharged from the wire plant into the city sewer system, it may be found possible to economically utilize the principle of chemical precipitation in the treatment of the sewage of the city.

Recommendations

That in view of the above I would recommend that the city of Cortland be required to construct within a reasonable time proper sewage disposal works to treat the sanitary sewage and trade wastes now discharged into the river from the city sewer system, and that the city be requested to submit within a definite time for the approval of this Department, satisfactory plans for such sewage disposal works.

I would further recommend that the attention of the city be called to the provision of section 76-a of the Public Health Law and that they be advised that it will be necessary for this Department to take action under said section if within a reasonable time steps are not taken by the city authorities to provide for proper treatment of the sewage and manufacturing wastes now discharged from the sewer system into the Tioughnioga river.

Respectfully submitted,
THEODORE HORTON,
Chief Engineer

ALBANY, N. Y., *December* 8, 1915.

A copy of this report was transmitted to the city authorities on January 11, 1916, and advices were received from them that the matter would be given careful consideration.

GOWANDA

HERMANN M. BIGGS, M.D., *State Commissioner of Health:*

An inspection of the tannery operated by C. Moench Sons Company at Gowanda, Cattaraugus county, with special reference to the pollution of Cattaraugus creek, was made on March 8, 1915.

The matter of the pollution of this stream by the tannery and the glue factory operated by the Eastern Tanners Glue Company, about 1,000 feet below the tannery, was referred to you by the State Conservation Commission, and an inspection of these plants was made at your direction by Mr. C. A. Holmquist, assistant engineer of this Department, on March 8, 1915. A separate report is being prepared on the inspection of the glue factory.

The tannery, of which Mr. H. L. Moench is president and general manager, is located in the southern part of the village of Gowanda, about one mile above the business portion of the village. It was found that this tannery

was established prior to 1864, and was operated under the firm name of Gaensslen Bros. of Cleveland, Ohio, until 1895, during which period sole leather was manufactured by the bark process. In 1895 the firm was changed to Gaensslen, Fisher & Co., who operated the tannery until 1899. The firm name was then changed to Moench, Fisher & Gaensslen and operated by them until 1905, when it was again changed to C. Moench Sons Co.

Although no permit for the discharge of wastes from the tannery has ever been issued by the Department, an industrial report submitted under chapter 468 of the Laws of 1903 was received from Moench, Fisher & Gaensslen on December 5, 1903. It appears from this report that the factory at that time employed 105 men and tanned about 720 sides of leather per day. The factory now tans about 800 sides of upper leather by the crome process, 800 sides of upper leather by the bark process, and 400 sides of sole leather by the bark process. It appears, therefore, that the output from the plant is practically three times as great as it was in 1903, and it was learned that the output of the plant was increased by about 25 per cent when the company commenced tanning sole leather in January of this year.

The process of manufacture is briefly as follows:

Preliminary operations

Both dry and green hides are tanned. The dry hides are milled dry for about three hours in order to soften them. The so-called green hides, which have been salted to preserve them, are soaked for about two days in water and are then milled for about one-half hour in water. The hides are then washed and soaked in water for one day, after which they are placed for another day in a solution of milk of lime. The hides are then paddled in a solution of sodium sulphide for one day and paddled or washed in water for another day. Up to this point the bark and the chrome processes of tanning are the same.

Sole leather (bark process)

After being washed the so-called bark upper and sole leather are bated for two hours in Oropon bate, after which the sole leather is placed in a weak solution of sulphuric acid for two days. The bark upper leather is placed in a weak solution of tanning liquor for three days, and the sole leather in a weak solution of tanning liquor for a period of six days, during which time the hides are changed and placed in a stronger solution every other day. The hides are then placed in strong tanning solution for about twenty days, during which time they are changed four times. The hides are then retanned with extract liquor, milled, dried, rolled and finished.

Upper leather (bark process)

This leather, after being washed, is placed in a tanning solution for eighteen days with six changes. The hides are then split and both the grain and the split sides are retanned in stronger tanning liquor for five days, after which the hides are wrung, pressed and stuffed with grease. They are then smoothed out and left to dry and buffed. The hides are then blacked or colored and given three or four coats of finish.

Upper leather (chrome process)

The chrome leather, after bating, is pickled in sulphuric acid and salt for twelve hours, after which they are split. The hides are then tanned by being placed in a bath of bichromate of soda and sulphuric acid for four hours, to which solution is added a solution of bisulphite of soda, in which the hides are milled for four or five hours. The hides are then drained and neutralized with a 2 per cent. solution of borax and washed in cold water for one hour,

after which they are dressed, shaved and colored. They are then set out to dry for two days and finished.

In the process of tanning 20 barrels of lime, 140 barrels of sodium sulphite, 12½ carboys of sulphuric acid, 4 barrels of Oropon bate, 197 cords of hemlock bark, 230 100-pound bags of mangrove bark, 6,800 gallons of chestnut wood extract, and 107 barrels of ambracho wood extract are used per month. Although it was impossible to determine with any degree of accuracy the exact amount of water used and the amount of wastes discharged, it was found that all of the wastes from the plant, including the wastes from the closets used by the employees are discharged into Cattaraugus creek through two outlets. The more objectionable of the trade wastes discharged into the stream amounts to about 25,000 gallons, and includes the sodium sulphide, Oropon bate, spent solution of sulphuric acid, tanning liquor and bichromate of soda and milk of lime.

It is found from inspection that the nature of the wastes varies considerably during the different parts of the day, so that it was impracticable to obtain a representative sample of the wastes discharged into the stream. At the time of the inspection the wastes were considerably discolored, due, it appeared, to the dyes and tanning liquors. Although the evidence of the discharge of the wastes disappeared at a comparatively short distance below the sewer outlets, it is evident that very objectionable conditions are created in the stream at certain times by the discharge of such wastes as sodium sulphide, Oropon bate and tanning liquors, which contain a large percentage of organic matter, and steps should be taken by the company to provide for a treatment of their wastes.

Although it is impracticable for this Department, with its limited funds and facilities, to give any but general suggestions, it may be stated that a treatment of the major portions of the wastes by sedimentation or chemical precipitation would, in all probability, relieve to a considerable extent the objectionable conditions caused by the discharge of wastes from this plant into the stream. Provisions should also be made to separate the sanitary or domestic sewage of the toilets of the tannery from the industrial wastes and to treat this sewage separately. I also believe that, while a plain sedimentation or chemical precipitation would improve the major portion of the wastes, such wastes as the stronger spent tanning liquors, the sodium sulphide and the bate, as well as the solutions containing sulphuric acid could be more economically treated separately inasmuch as, if mixed with the less objectionable wastes, all of the wastes would, in all probability, require a higher degree of purification to render them inoffensive than could be obtained by sedimentation or chemical precipitation.

The Moench Sons Company should be advised to employ the services of an expert, familiar with the disposal of industrial wastes, to make a study as to the most appropriate method of caring for their wastes, and to prepare plans for the same and submit them to this Department for approval as required by law.

In conclusion, I would state that it is found from the inspection that the discharge of wastes from this plant constitutes a violation of section 76 of the Public Health Law, inasmuch as the amount of waste discharged into the stream has increased considerably since 1903, and since no permit allowing the discharge of effluent from this plant has ever been issued by this Department. Although no attempt was made to determine with any degree of accuracy the relative responsibility of the tannery and the glue factory for the pollution of Cattaraugus creek, it was found that the discharge of wastes into the stream by the tannery created objectionable conditions.

In view of the above, and in order to improve the conditions of the stream, I would recommend that the matter of abating the nuisance caused by the discharge of wastes from the tannery by providing for a proper treatment of such wastes be taken up with the tannery owners. I would also recommend that a copy of this report be sent to C. M. Moench Sons Company in order to assist them as far as possible in solving the problem of caring for the wastes from their plant.

gallons per day. A hospital is being built and when complete will contain a flush closet, bath, etc. No provision has yet been made to dispose of the sewage from the building, which is situated approximately a quarter of a mile from the main disposal plant. The well and hand pump, mentioned above, which is used to fill the water pitchers, is located in a field below the hospital site, consequently care must be exercised not to pollute this well when sewage disposal for the hospital is provided.

The sewage from the laundry and store is discharged through an old wooden pipe which connects with the effluent pipe from the main disposal plant. It is estimated that from 2,000 to 3,000 gallons are discharged daily from the laundry for about four days in the week.

The main disposal plant is situated in the northeastern part of the property. A 6-inch main sewer conveys not only sanitary sewage to the disposal plant but also the overflow from the swimming tank. The engineer was informed that no surface water or roof water is discharged through this sewer. However, there is said to be a constant flow through the swimming tank and the tank is completely emptied every two weeks, which would discharge some 74,800 gallons during a short period through the sewer and disposal plant.

The disposal plant consists of a combined settling tank and strainer and an artificially constructed subsurface irrigation field. The tank is built of brick with a flag stone and concrete top, covered with earth. Its dimensions were given as 24 feet by 8 feet by 8 feet and the tank is divided into three compartments, the last two containing alternate layers of cobble stone, gravel and charcoal. After flowing through the settling compartment where the sewage has an estimated period of settling of 5 hours, it enters successively at the bottom of the two strainer beds from which it passes to the subsurface irrigation field. The tank is cleaned every two years.

At the irrigation field the sewage enters a chamber from which it overflows through parallel lines of agricultural tile pipe laid in stone and covered by earth. Several lines, about 100 feet long are laid in a total width of 5 feet, and the separate pipes are laid with ends as close together as possible. The lines of tile pipe discharge into a chamber at the end of the bed similar to the one at the inlet end, no underdrains or other outlet being provided.

A 6-inch outfall sewer after connecting with the sewer from the laundry discharges into a watercourse or ditch in which there is no flow other than the sewage except in times of storm. The effluent at the time of the inspection was highly putrescent and gave off a foul odor. The ditch passes across the Wasson property to Black creek which flows through the village of Altamont. There is apparently no nearby stream of any size with which the effluent from the disposal plant could be discharged. At the time of the inspection excavation had been commenced with the intention of constructing a subsurface irrigation field similar to the one already in use and which would receive the effluent from the disposal plant and the raw sewage from the laundry.

The disposal plant was built about seven years ago and was added to about three years ago although the Y. W. C. A. camp has been established at this location for thirteen years. The discharge of effluent from the disposal plant into a watercourse of the State without the permission of the State Commissioner of Health therefore, constitutes a violation of the Public Health Law.

The main disposal plant is inadequate and there are many imperfections in its design. The settling tank and stone and charcoal strainer allow the sewage to reach an advanced stage of putrefaction, while it is probable that the subsurface irrigation system has little effect and that the sewage merely passes through it from one end to the other without any material change. An absorption field, too limited in area, has been constructed in impervious soil and provided with parallel lines of drain pipe laid close together on a grade of approximately 2 per cent and not underdrained. Therefore, little opportunity has been provided for the sewage to leave the drain tile and it is apparent that the limited area, used constantly, will soon become clogged and more impervious than the surrounding soil. The operation is further complicated by the flushing action of the water from the swimming pool during its biweekly cleanings.

The sewage from the hospital must be cared for with the alternatives of providing a separate disposal plant or conveying the sewage to a main disposal works, and each alternative must consider the sanitary protection of the nearby well. Also the laundry wastes and dish water with their high percentage of grease and soap must have proper disposal.

In view of the fact that the buildings are widely separated the problem of the possible relocation of the disposal plant, with the object of better facilities and less expense in conducting the sewage to it should be studied. Although the soil from a superficial examination does not appear to be well adapted to the use of a system of subsurface irrigation, the possibility of using such a system should be carefully considered in view of its economy.

To determine the most economical and efficient method of disposition of the sewage from the camp will, it is evident, require the gathering of more complete data such as can be obtained only by surveys and close study and as this Department has neither the men nor funds to undertake this work, the camp authorities will achieve the greatest ultimate economy and permanency of result by employing a competent sanitary engineer.

The danger of a serious outbreak of disease occurring at the camp through insanitary conditions arising from improper methods of sewage disposal, in conjunction with the desire of the camp authorities not to create a nuisance or jeopardize the health of others, should lead them to take steps which will permanently and adequately provide for the disposal of all sewage. The sewerage system and disposal works should be complete and should provide for all future exigencies. A camp of this kind where one of the principal objects is the up-building of health should be founded on firm sanitary principles in all things. The plans prepared by a sanitary engineer, if the system designed included the discharge of sewage or sewerage effluent into a watercourse of the State must be submitted to this Department for approval as required by the Public Health Law.

In conclusion I would recommend that copies of this report be transmitted to the camp authorities, to Miss Mary M. Wasson and to the local board of health.

Respectfully submitted,
THEODORE HORTON,
Chief Engineer

ALBANY, N. Y., *July* 17, 1915

LAKE GEORGE

HERMANN M. BIGGS, M. D., *State Commissioner of Health:*

An investigation of the pollution of Lake George with special reference to the discharge of sewage and other refuse matters into the lake from summer resorts and cottages at Hulett's Landing and Cleverdale and from the steamboats was made on August 14 and 16 by Mr. C. A. Howland, inspecting engineer, at the request of Dr. A. Jacobi of New York City, who is chairman of the Sanitary Committee of the Lake George Association.

Before entering upon the details of this report it may be pointed out that the matter of the sanitary condition of Lake George is one that has received the especial attention of this Department, special investigations and reports having been made at the request of the Lake George Association in 1907, 1910 and 1911, and other investigations made in connection with the regular inspections of summer resorts in 1911, 1912 and 1913. As the result of these investigations and reports considerable correspondence has passed between, and many notices have been served upon, not only local authorities which by statute have special jurisdiction in this matter, but also hotel proprietors, steamboat companies, and individuals who were found to be polluting the waters of the lake.

While the records of the Department show that many cases of pollution of the lake and other insanitary conditions have been corrected notwithstanding the limited direct authority of the State Department of Health and the general inaction of local authorities, it is obvious that further cooperation is needed in order to correct insanitary conditions that have not been previously abated or which have recurred.

During the present investigation which was made in part in company with Dr. Jacobi a number of places along the lake were visited and inspected, including the Algonquin Hotel, Fort William Henry Hotel, Hulett's Landing, Cleverdale and the steamboats of the Lake George Navigation Company. At the Algonquin Hotel, it was found that the water supply is derived for drinking and cooking from a spring and that water for other purposes is pumped from the lake into a wooden reservoir 12 feet in diameter and 12 feet deep. A 6-inch sewer discharges the sewage from a total population of about 65 persons into a cesspool from which it overflows into a second cesspool. Although the second cesspool is said to have no overflow pipe, a discharge having the characteristic odor of sanitary sewage was running into the lake at a point below the cesspool. The bar is located on the shore and the bar wastes are discharged into a barrel on the shore of the lake. These two outlets are within 75 feet of the water intake.

A visit was made to a cottage owned by a Mr. Anderson of Albany. It was found that the water supply for this place is taken directly from the lake and the sewage is discharged into a cesspool which has been relocated at a point about 50 feet from the water's edge in made land of a sandy nature.

At the Fort William Henry Hotel the water supply is derived from the Lake George village supply, a maximum of about 200,000 gallons per day being used. The sewage is discharged into a settling tank constructed of concrete and brick, which is 12 feet by 12 feet in plan and 21 feet deep. The unusual depth is made necessary by the depth of the sewer. From the settling tank the sewage is pumped to a cesspool 60 feet by 60 feet by 20 feet, constructed with hollow tile walls. An ejector forces the sewage from a number of connected buildings known as the pagoda, located along the shore of the lake, to the settling tank. The wastes from the laundry are pumped directly to the cesspool. A connection is provided on the force main from the settling tank, to drain the force main into a cesspool used by the steamboat company and the railroad.

The engineer was able, during the investigation to inspect all three of the large steamboats. It was found that each of these is provided with closed cylindrical iron tanks into which the sewage discharges. At the southern or Lake George end of the lake connections are provided on the dock together with an air compressor, by means of which the sewage is forced into a cesspool located on the hill. Compressed air is not used by the Mohican which pumps its sewage directly by pumps, located in the boat. Garbage and refuse are disposed of on shore. The dish water from the kitchen, however, because the sinks are placed too low for the wastes to flow into the sewage tanks, is discharged directly into the lake. Water from vegetable washing flows into the bilge from which it is pumped into the lake with the bilge water.

The air compressor on the dock is also used to force the sewage from a closed iron tank into which the sewage from the railroad station discharges. This sewage is discharged into the cesspool used for the steamboats sewage.

A careful investigation was made of the sanitary condition of the cottages and hotel, located at Hulett's Landing. Some twenty cottages, are located on land owned by Mr. C. H. Buckell. This property, consisting principally of flat land adjoining the lake, was originally a marsh. It has been partially filled in with sand to an average depth of about 1 foot and the subsoil is the original black muck. The parts of the property more distant from the lake are at a higher elevation and the soil is loam. The water supply for all of the cottages is derived from Cascade brook at a point about one-half mile east of the camp site. The engineer visited the intake and found that a masonry dam about 10 feet high has been constructed across the creek. The dam is provided with a waste gate and intake racks and screen. Only a small quantity of water is impounded.

The watershed of Cascade brook, above the intake, is steep and wooded for a considerable distance. Few houses are located on the watershed but there is, however, danger of pollution of the water not only from these and the road which follows the stream but also from parties tramping or picnicing in the woods. The water is distributed to the several cottages through cast-iron pipes laid on the surface of the ground.

Of the 20 cottages, ranging in number of occupants from 2 to 12 persons, 7 have flush closets, 6 have privies, some with vaults and some without. Those places having flush closets discharge the sewage into covered cesspools about 5 feet by 5 feet in plan and 4 feet deep, excavated in the sand and muck. As the subsoil is continually saturated, the sewage cannot leach from the cesspools and they fill up and must be emptied. One of these, used in connection with a large cottage standing on elevated ground in the southern part of the property, was overflowing at the time of the investigation and the sewage was flowing over the ground to a ditch which had been dug parallel to a small stream flowing into the lake.

The privies provided with removable buckets were apparently in fairly sanitary condition and the pails, it was stated, are emptied daily. As all of the houses are provided with running water, there is usually a kitchen sink although no flush closet may be installed, and the wastes from these sinks are disposed of in cesspools similar to the others. Although the sanitary condition of many of the privies was not good, because of their dilapidated condition and large accumulations of fecal matter, yet in no instance were they located so that odors arising from them affected the public in general at the time of the inspection and they cannot be said, therefore, to constitute public nuisances.

The garbage from the Buckell property is fed to hogs and is spread on the ground in a large pen, evidently in excess of the amount the hogs can eat because quantities had rotted on the ground and this garbage was covered with swarms of flies and gave rise to a foul odor, which under certain conditions of the wind and atmosphere would be perceptible at the nearby cottages.

It may be said in regard to the Buckell property that the location is unfortunate because the saturated condition of the ground makes the disposal of sewage difficult. Greater care should be used in the maintenance of the privies and of the disposal of the garbage. The filling in of the land should continue as rapidly as possible to a point where a dry, well-drained surface can be obtained.

The engineer also inspected the hotel at Hulett's Landing owned by W. H. Wyatt. A total population of 250 including employes is cared for at this hotel. The water supply is derived from the source which supplies the Buckell property, described above, and from a spring. The sewage is disposed of in three cesspools, one of which is a large one located near the main building, the wastes from which are discharged into it. This cesspool overflows into a marshy area which drains into Foster brook, a tributary of Lake George. This overflowing cesspool is situated about 20 feet from a cottage.

A large double privy is used by the employes. At the time of the inspection the garbage was stored before removal in uncovered barrels and is fed to hogs. The wastes from the laundry which is a separate building were exposed on the surface of the ground.

The engineer then visited and inspected the sanitary conditions existing at Cleverdale, a peninsula which juts into the lake between Harris and Sandy Bays. About 100 cottages are located on this point, being situated generally along both shores of the point. The majority of the cottages are owned by the individuals who occupy them and are of the better class. There are a number of boarding houses but no hotel.

A water supply is available on the point. The water is pumped from Harris Bay, through a 2-inch pipe the intake end of which is located about 25 feet from shore in about 6 feet of water and is protected by a screen. A gasoline engine raises the water to an elevated tank which has a capacity of

about 2,300 gallons and as it is pumped full six times a day about 14,000 gallons are used daily to supply the 75 houses connected with the system. The intake is about midway of the point and there is therefore bathing on both sides of it.

Many of the cottages, either supplement the public supply or use the lake water entirely, pumped through individual intakes, which are seldom located very far from shore or in very deep water. Of the 100 cottages, it was estimated that from 15 to 20 have flush closets while the rest use privies, although nearly all of the places have kitchen sinks. The engineer discovered few evidences of direct pollution of the lake water by sewage. At the place owned by Mrs. L. W. Ackerman a drain runs from the kitchen sink to the lake but it is claimed that it is not used.

As the soil of the region consists of from 1 to 3 feet of clayey loam overlying hardpan, the disposal of sewage into cesspools is difficult. A number of these have, however, been built both for kitchen wastes and for fecal wastes and some of them are filled with stone. As far as could be discovered these are not provided with overflow pipes to the lake, but if they fill up before the end of the season, they are emptied. It was stated that some of these when dug contain several feet of water but that when sewage is discharged into them they do not overflow. If this is the case it is apparent that the flow of ground water is sufficient to dispose of the sewage. A large majority of the cottages have outside privies, some of which are in a filthy condition and should be cleaned more frequently. The engineer was informed that repeated complaints have been made in regard to odors arising from these privies.

As a result of this investigation it appears that direct pollution of Lake George was occurring by sewage from a number of places among which may be mentioned the Algonquin Hotel, where the overflow from the cesspool drains into the lake and bar wastes are discharged in such a manner as to readily find their way into the lake; the hotel at Hulett's Landing owned by W. H. Wyatt where the overflow from the cesspool drains into a tributary of the lake; a building on the property of W. H. Buckell, the sewage from which was overflowing from a cesspool in such a manner as to drain into a tributary of Lake George; the property of Mrs. L. W. Ackerman at Cleverdale where a kitchen sink drain discharges into Sandy Bay and the Lake George Navigation Co. whose boats discharge kitchen wastes directly into the lake. This pollution of the lake, from which many water supplies for individual and public consumption are derived, not only endangers the public health and creates serious nuisances but is also in violation of the Public Health Law and Navigation Law.

The investigation has also shown that there exists at a number of places about the lake insanitary conditions which, while they may not technically be considered public nuisances should, however, be corrected, such as the privy at the cottage occupied by the Rogers family at Hulett's Landing and the Vance privy at Cleverdale. The odors arising from the rotting garbage on the Buckell property at Hulett's Landing may however, be said to constitute a public nuisance since a number of the public are affected.

In view of these data, gathered during this investigation it is apparent that action should be taken at once to abate the insanitary conditions which not only create nuisances but also endanger the health of the public through contamination of the water supplies derived from the lake. While the correction of these conditions lies principally with the local authorities under the specific powers imparted by the Navigation Law it would seem that some action should also be taken by this Department under the provisions of the Public Health Law. I would recommend that copies of this report be transmitted to the local Boards of Health of the towns of Dresden, Bolton and Queensbury in which the insanitary conditions were found and that they be directed to take immediate steps to abate the insanitary conditions referred to above.

I would further recommend that a copy of this report be transmitted to the Lake George Association and that they be urged to continue the effective

work which they have instituted and are carrying out, and to cooperate with the State and local authorities so far as possible in still further improving the sanitary condition of this district.

Respectfully submitted,
THEODORE HORTON,
Chief Engineer

ALBANY, N. Y., *August* 19, 1915

Memorandum of Mr. Holmquist regarding second inspection on September 2, 1915, of the steamboats of the Lake George Navigation Co. and various resorts along Lake George with special reference to the pollution of the lake

The first inspection was made by Mr. C. A. Howland on August 14 and 16, 1915, at the request and with the assistance of Dr. A. Jacobi of New York City, Chairman of the Sanitation Committee of the Lake George Association. The following cases of pollution of Lake George were found at that time:

1. Sink wastes were being discharged into Lake George from two of the steamers of the Lake George Navigation Company.
2. A drain extended from a sink to the lake at the property of Mrs. L. W. Ackerman at Cleverdale, town of Queensbury.
3. Overflow from a cesspool at a cottage owned by Mr. C. H. Buckell at Huletts Landing, town of Dresden, drained into a small stream tributary to Lake George.
4. Overflow from a cesspool at Wyatt's Hotel at Hulett's Landing drained into a tributary of the lake.
5. A cesspool at the Algonquin Hotel near Bolton Landing overflowed into Lake George.

A letter enclosing a copy of the report of the inspection was sent to the manager of the Lake George Navigation Company on August 20, 1915, calling his attention to the pollution of the lake by the discharge of wastes from steamboats and requesting him to take steps to provide for the proper disposal of sink wastes by discharging them into the storage tanks which receive the sewage from the toilet rooms or by providing additional tanks for the kitchen wastes. Letters enclosing copies of the reports were also sent to the health officers of the towns of Queensbury, Dresden and Bolton on August 20, requesting them to at once present the matter to the local boards of health for action under the provisions of the Public Health Law.

A statement of the conditions found at the time of the reinspection on September 2, 1915, follows:

1. No changes have been made in the method of disposing of the wastes and sewage from the passenger boats of the Lake George Navigation Company. Although the sewage from the toilet rooms appeared to be disposed of satisfactorily by discharging it into steel storage tanks and pumping it into cesspools located at a considerable distance from the lake, the sink wastes are still being discharged into the lake. As stated in the report based on Mr. Howland's inspection, the storage tanks of the steamers are located at too high an elevation to permit of draining the sink wastes into them by gravity flow and in order to dispose of them in the same manner as the sewage it would be necessary either to lower the present tanks or to install additional tanks to care for the sink wastes. Inasmuch as the solids in these wastes are largely in solution or finely divided they are quickly dispersed and are not likely to create a nuisance when discharged into the lake and since such discharge is probably not a menace to public health, it does not appear that it should be necessary to take any further action in the matter.
2. The drain from the cottage of Mr. L. W. Ackerman was found to take roof water and drippings from a fresh water faucet in a shed outside of the

cottage. It appeared that the dishes are washed in the kitchen adjacent to the shed and that the dish water is thrown out on top of the ground back of the cottage. There was no evidence of any dish water or sink wastes having been discharged from the drain which terminates near the top of the bank a few feet from the water's edge. Mrs. Ackerman stated that although no sink wastes had ever been discharged into this drain she would have it removed at once in order to avoid even a suspicion of the pollution of the lake from her cottage.

3. The overflow from the cesspool at the cottage in the southerly section of the Buckell property had been stopped. It had been found that the overflow was due to a leak in the water pipe at the cottage which flowed into the cesspool and that the overflow from the cesspool ceased when the water main was repaired. A second cesspool has been constructed to take the overflow, if any, from the first cesspool.

4. It was found that as the result of action taken by the local board of health attempts had been made to temporarily eliminate as far as practicable the overflow from the cesspool at the hotel owned by W. H. Wyatt at Hulett's Landing into Foster brook by the construction of a ditch which intercepts the overflow from the cesspool and prevents it from flowing directly into the brook. The greater portion of the overflow from the cesspool spreads over a section of the swamp near the hotel and is absorbed by the soil or filters through the soil before reaching the stream. The overflow of the cesspool could not be entirely stopped without closing the hotel or providing some other means of disposal and since most of the guests of the hotel had already left for home at the time of the inspection and inasmuch as the hotel is to close for the season between September 15 and October 1, it does not appear to be worth while to take any further action in the matter this year. The health officer of the town of Dresden stated that the local board of health had served a notice on the owner of the hotel requiring him to provide adequate means for the disposal of the sewage from the hotel before next season.

The proprietor of the hotel was interviewed and advised of the violation of the navigation and the Public Health Laws due to overflow of the cesspool into a stream tributary to Lake George and the serious conditions that might arise from such overflow were pointed out to him. He was also advised to secure the services of a competent sanitary engineer to prepare plans for an adequate sewage disposal plant to care for the sewage from the hotel and to submit the plans to this Department for approval before the construction of the plant. It was pointed out to him that in all probability the only satisfactory method of caring for the sewage from the hotel, owing to its low elevation with reference to the lake, would be to construct a concrete receiving tank for the sewage and to pump the sewage from such a tank, which should be as water tight as possible, to a suitable site for disposal away from the lake. Mr. Wyatt stated that he would take immediate steps to follow out these recommendations.

5. In response to an order from the local board of health the cesspool at the Algonquin Hotel located some 50 feet from the lake is pumped into barrels as soon as the cesspool fills up and the sewage is drawn away for disposal on high ground on the hotel property at a considerable distance from the lake. Although it was stated by the proprietor of the hotel that the cesspool had been pumped out a few days before, it had apparently filled up again and had commenced to overflow at the time of the inspection. The proprietor said he would have the cesspool pumped out immediately and look after it more carefully so that it will not overflow again before the hotel closes which will be about October 1.

He also stated that he proposed to construct a concrete tank at the site of the present cesspool from which the sewage is to be pumped to a disposal field on the hotel property back of the hotel. He was advised that plans for the proposed method of caring for the sewage should be submitted to this Department for approval before the construction of the plant.

It appears, therefore, that inasmuch as the overflow from the cesspool at the Algonquin will be largely if not entirely eliminated for the rest of the

season and since steps are to be taken to properly dispose of the sewage before the beginning of the next season no further action need be taken in this case.

Summary and conclusions

The recent inspection showed as follows:

Case No. 1. No change had been made in the disposal of sink wastes from boats.

Case No. 2. There is no pollution of the lake from the drain at Ackerman cottage.

Case No. 3. Overflow from the cesspool on Buckell property eliminated.

Cases No. 4 and No. 5. Overflow from cesspools at the Wyatt and Algonquin hotels temporarily or partially eliminated. Steps to be taken to permanently care for the sewage before next season.

It may be stated in conclusion that except in the case of the discharge of sink wastes from the steamers of the Lake George Navigation Co., the cases of pollution of Lake George found at the inspection of Mr. Howland on August 14 and August 15, 1915, have either been entirely eliminated or at least partially remedied and that steps are to be taken by the property owners before next summer to provide for the proper disposal of the sewage and prevent its discharge into Lake George. I am of the opinion that nothing could be gained by taking any further action in the matter at this time but that an inspection of the steamers of the Lake George Navigation Co., the Algonquin and Wyatt Hotels should be made before the opening of the next summer season.

Dr. Jacobi was interviewed after the recent inspection and advised of the steps taken by the Department and the local boards of health to stop the pollution of the lake and of the improvements made since the previous inspection. He was very much pleased with the results of the action taken by this Department and expressed his appreciation to Dr. Biggs for the interest taken in the matter of improving the conditions at the lake.

ALBANY, N. Y., *September* 2, 1915

SENECA (town)

Memorandum regarding sauerkraut factory nuisance, Hall, N. Y.

Mr. Cleveland visited Hall (Halls Corners) in the town of Seneca, Ontario county, on December 24, and investigated conditions with reference to the discharge of wastes and wash water from a sauerkraut factory into a highway ditch and thence into Burrell creek, tributary to Wilson creek and Seneca lake.

The factory is owned by Libby, McNeil & Libby, Union Stock Yards, Chicago, and is situated on the westerly side of the right of way of the Northern Central R. R. Mr. Edward Tilden is president of Libby, McNeil & Libby Co., and Mr. Phillip Larmon is general superintendent, C. N. Kikkert is manager of the Hall plant and F. O. Green, a representative of the company, was temporarily stationed at the plant. The plant was constructed in 1910.

The number of employes at the plant is 25 during the winter months and 95 during the fall season from September 15 to December 1, when cabbage is being cut.

The output ranges from 1300 tons as in the season of 1913 and 1914 to 5000 tons of kraut annually as in the season of 1914 and 1915. About one-half of the product is barrelled and about one-half canned in 2½-pound cans. The greater part of this canning being done in the fall but about 4 or 5 barrels are canned daily during December, January and February.

The water supply is pumped from a driven well and about 500 gallons, it was estimated, were used in the processes carried on and in the washing.

The factory was not in operation at the time of the inspection and no evidence of insanitary conditions was present but it was admitted by the manager of the factory that the methods of disposing of the wastes heretofore employed had resulted in creating a nuisance. These wastes, which consist of washings from floors and machinery had heretofore been discharged into cesspools in clay soil northerly from the factory and by reason of the impervious character of the soil the wastes have found their way into a ditch crossing the railroad about one-quarter of a mile northwesterly from the factory and through this ditch into Burrell creek a tributary to Wilson creek which discharges into Seneca lake at a point 7 miles below the point where Burrell creek receives the wastes.

It was learned that cellar drains which discharge into this highway ditch were in such a position that the wastes backed up into the cellars of 2 or 3 residences along the highway.

The inspection was made in company with Mr. Kikkert and Mr. Green, representing the company, and Dr. Selover. The manager, Mr. Kikkert, stated that the company realized that some other disposition should be made of their wastes and it had taken up with the railroad company prior to the inspection the question of obtaining a right of way to carry the waste water directly across the railroad track and onto a wooded area remote from highways northeasterly from the plant.

Mr. Cleveland advised them to obtain the services of a sanitary engineer in designing works for providing means for properly disposing of the wastes and stated that it might be possible for an engineer to arrange for satisfactory disposition of the wastes on this wooded area although it would be necessary to make special provision for disposing of wastes over a considerable area of soil or to provide artificial works for proper treatment of the wastes. The attention of the manager was called to the fact that if the plans for treatment of the wastes, when prepared, should provide for discharge of effluent into the stream that the plans must necessarily be submitted to the State Department of Health for approval.

The manager signified his intention of recommending to the company that a sanitary engineer be engaged to study the problem and suggest means for properly disposing of the wastes and stated that steps would be taken to obtain a right of way across the railroad tracks or the purchase of land on the northwesterly side of the railroad tracks on which to locate a disposal plant or on which to discharge the wastes.

ALBANY, N. Y., *February* 24, 1915

STOCKTON (town)

HERMANN M. BIGGS, M.D., *State Commissioner of Health:*

An investigation of the pollution of a stream in the town of Stockton, Chautauqua county, by wastes from the factory of the Cassadaga Ice Cream and Butter Company was made on June 30 by Mr. C. M. Baker, assistant engineer in company with Dr. J. J. Mahoney, district sanitary supervisor.

This investigation was made at the request of the directors of the company for information regarding the proper method of disposing of their wastes. Prior to this time no information had been furnished the Department regarding the existence of such pollution, no permit having been requested for discharging the wastes into the stream as is required by law.

The factory, which is housed in a frame building 30 by 50 feet in dimension, is located at Burnhams on the Dunkirk, Alleghany Valley & Pittsburgh railroad and was opened for business January 1, 1914. The data regarding operation of the plant, amount of wastes, etc., was obtained from the butter

maker, who is in direct charge of the factory, and also from Messrs. Burnham and Albee, members of the board of directors. The regular employes consist of a butter maker and his assistant.

The plant is operated continuously. During the first two weeks of June the records show that 11,436 pounds of butter and 52 gallons of ice cream had been manufactured and although there is some variation in the amount of products during the year, it was stated that these figures are not far from the average. The amount of milk received during this period was approximately 229,000 pounds. There has been a gradual growth in the amount of business since the factory was opened and it is assumed that an increase of 30 to 50 per cent. may still be expected.

The wastes consist only of wash water from the floor, churns, etc., the butter milk being all taken by the farmers. It is thus apparent that the amount of wastes is practically equivalent to the amount of water used and that it contains considerable milk or organic matter practically in solution. The water is obtained from a well located in one corner of the building and the amount used is estimated at 800 gallons per day. With the increased output of the plant the water consumption will probably increase to 1,000 or 1,200 gallons daily. The variation during the year in the output of the factory will have little, if any, effect on the amount of wastes.

The wastes are discharged through a 4-inch tile drain directly into a small stream which empties into the Cassadaga creek. The stream is dry during the summer and the slope is slight so that the water stands in pools, and the organic matter putrifies causing very disagreeable odors. The highway leading from the railroad station of the village of Cassadaga crosses the stream practically at the point where the drain from the creamery discharges and, although there had been heavy rain just prior to the time of the inspection and there was considerable water in the stream, there was a strong and disagreeable odor at this point. There are several residences in the vicinity and at times during the summer, the conditions caused by the discharge of the wastes from the factory into this dry watercourse near them must be very disagreeable.

In view of the above it is apparent that adequate purification should be provided to properly care for the wastes from this factory. Settling tanks alone probably will not meet this requirement. I would recommend, therefore, that the company employ a competent engineer to prepare plans for properly disposing of the wastes from their factory and that the plans be submitted to and approved by the State Department of Health as is required by law.

Respectfully submitted,
THEODORE HORTON,
Chief Engineer

ALBANY, N. Y., *July* 13, 1915

WAWAYANDA (town)

HERMANN M. BIGGS, M.D., *State Commissioner of Health:*

An inspection of a nuisance due to the discharge of wastes from a creamery into a ditch in the town of Wawayanda, Orange county, was made on April 15, 1915, by Mr. C. A. Howland, assistant engineer, in company with Dr. Robert Cordner, health officer of the town of Wawayanda. A complaint was received from Mr. C. H. Smith, county superintendent of Orange county in regard to the alleged nuisance due to the discharge of wastes of this creamery.

A cheese factory owned by the successors of Francesco Alleva of 190 Grand street, New York city, is located near the railroad tracks at a point of about one-quarter of a mile southwest of Slate Hill. The first factory at this place was established some eight years ago and the present plant was built in 1914. Italian cheese and whey cheese are manufactured at this point, for which

milk is obtained from farmers and skimmed milk is purchased from the Clover Farm Creamery at Slate Hill.

The curds are separated from the milk by the addition of rennet and the whey is boiled to obtain the whey cheese. The curds and whey cheese are shipped to New York for further treatment. The wastes therefore consist of the whey, after the whey cheese has been removed, and the wash water from cans, utensils and floors. The only chemicals which would be contained in these wastes are washing powder and a very slight amount of sulphuric acid used in tests for butter fat.

The wastes are discharged through inlets in the concrete floor of the building into two drain pipes which unite and pass into a blind ditch, i. e., a ditch filled with stones. This blind ditch connects with a tile pipe which carries the wastes under the railroad tracks beyond which they flow over the surface of the ground into a ravine. The wastes flow through the ravine and emerge into a road ditch on a highway. This ditch along the road discharges into a marshy area which is drained by a small stream tributary to the Wallkill river. At the time of the inspection wastes were discharged into the ditch along the road, and the odor therefrom was very marked.

The water supply from the factory is obtained from a dug well about 4 feet in diameter and 10 feet deep constructed with rough stone walls. The well is located at an elevation below the railroad tracks on the side opposite the creamery. From computations made by the engineer it would seem that some 300 to 400 gallons of water are pumped per day under normal conditions from the well to a tank in the attic.

At the time of the inspection two cesspools were being dug below the railroad tracks on the side opposite to the factory, and about 40 feet from the well. It was intended to construct two cesspools and to connect them by a blind ditch. Other cesspools were also to be constructed in the rear of the factory. The soil of the region is apparently only slightly porous and it is doubtful if such a system of disposal of the wastes would be found permanent. A pipe line has also been constructed from the rear of the factory to pig pens located about 400 feet distant. It is proposed to discharge the whey through this pipe line and feed it to hogs of which there were five or six. Some of the whey is taken by farmer and it is proposed to feed as much as possible of the remainder to hogs of which a number more are to be obtained.

An examination of the surrounding region in relation to sewage disposal shows that the ground is at least at this time of the year somewhat marshy and it is doubtful because of this fact and the nonporous nature of the soil if any system of cesspools would operate effectively for any considerable period of time. There is available near the factory considerable area of ground on which a system of subsurface irrigation or broad irrigation might possibly be located or some form of filter constructed. The nearby watercourse into which the effluent from a disposal plant could be discharged is not large and lies some distance away.

I would, therefore, recommend that the successors of Francesco Alleva be advised that the present method of disposal of the wastes from the factory at Slate Hill not only results in a public nuisance affecting a considerable number of persons but is also in violation of the Public Health Law, since the effluent discharges into a watercourse of this state without the permission of the State Commissioner of Health. It would recommend further that they be advised to employ a competent sanitary engineer to study the question of disposal of wastes from their plant and to design a system of sewage disposal which shall dispose of the wastes permanently in such a manner that a public nuisance will not be created. If it is proposed to discharge the wastes after treatment in a disposal plant into a watercourse of the State, permission for such discharge must be obtained from the State Commissioner of Health.

In conclusion I would recommend that copies of this report be transmitted to the successors of Francesco Alleva and to Robert Cordner, M. D., health officer of the town of Wawayanda, and to Mr. C. H. Smith, county superintendent of Orange county.

Respectfully submitted,
THEODORE HORTON,
Chief Engineer

ALBANY, N. Y., *May* 1, 1915

In addition to the foregoing, inspections were made and reports transmitted to the local authorities and advice was given through correspondence, in the matter of the abatement of cases of stream pollution at the following places:

Akron,
Altamont,
Big Moose,
Brookfield,
Cassadaga,
Gloversville,
Hamburg,
Highland,
Keuka Lake Outlet,
Lake Mahopac,
Munnsville,
Oakfield,
Ontario Center,
Oyster Bay,
Perrysburg,
Plattsburg,
South Fallsburg,
Tonawanda (town)
Walden, (3)
Waterloo,
Watertown,
Williamson.

INVESTIGATION OF PUBLIC NUISANCES NOT ARISING FROM STREAM POLLUTION

INVESTIGATION OF PUBLIC NUISANCES NOT ARISING FROM STREAM POLLUTION

On March 1, 1915, the Public Health Council of this Department, by the enactment of chapter VI of the Sanitary Code, clearly defined the procedure to be followed by local health officers and boards of health in abating nuisances which may affect life and health in political divisions of the State outside of cities. This chapter of the Sanitary Code supplements the provisions of the Public Health Law dealing with nuisances.

Both of these divisions of the law definitely place the abatement of nuisances within the jurisdiction of the local board of health. However, because of the technical features involved or for other reason, this Department is frequently called upon to assist with advice or by an inspection and report, in cases of nuisances where a satisfactory adjustment has not been reached.

In such cases, the local health authorities are fully advised as to the means to be used in abating the conditions of nuisance or where necessary a thorough investigation is made and a report prepared, which is transmitted to the local authorities with proper advice. The reports of the investigations made by this Department in the more important cases of nuisances which have come before it during 1915 are given below and a list is appended of all other cases.

EAST AURORA

HERMANN M. BIGGS, M.D., *State Commissioner of Health:*

An inspection of a municipal refuse dump located adjacent to the sewage disposal plant of the village of East Aurora was made on May 6, 1915, as the result of a complaint made by Mrs. Lavinia Pratt of a nuisance caused by insanitary conditions existing at the dump.

This dump is located in the southwest corner of the village and is on the property of the village on land purchased for the site of the disposal plant. The complainant lives about 1,200 feet from the dump. The dump lies chiefly between the contact beds of the disposal plant and a small brook which flows past the plant and empties into the east branch of Cazenovia creek about 50 feet below the dump.

The inspection was made by Mr. M. F. Sanborn, assistant engineer of the Department, in company with the health officer of the village, Dr. E. W. Buffum, and also the president of the village, the superintendent of streets, and Mrs. Pratt.

This dump has been used about two years and the refuse consists chiefly of old barrels, boxes, cans, tubs, bedding, paper, rags, bottles, and various

other substances. Very little ashes were found on the dump. Considerable garbage could be seen, the most of which had been there for several months or a year. An attempt had been made to get rid of the garbage by building fires on top of it, but this only resulted in producing bad odors and burning the top of the garbage.

The dump had extended over the end of the effluent pipe from the disposal plant and the effluent could be seen issuing at various places from beneath the dump. The dump had also encroached on the brook and at places the brook flowed beneath the dump. This condition has caused some of the smaller articles in the dump to be washed away and they could be seen stranded along the main creek below the brook.

The older parts of the dump had been covered with a few inches of earth and presented a comparatively good appearance.

It was stated by the superintendent of streets that garbage was not supposed to be placed on the dump, although there were no signs posted to that effect. The dump was apparently open to anybody who wanted to place rubbish of any sort there.

The week during which the inspection was made was "clean up week" and the village had several teams hauling rubbish to the dump. The combustible matter was burned at the dump. No evidence of garbage was seen in the loads dumped during the inspection.

It is evident, therefore, from this inspection that the condition of the dump as it has been maintained in the past was such as to create a nuisance for the following reasons:

1. The dumping and burning of garbage and the exposure of garbage on the dump for several months create unpleasant odors and form breeding places for flies.
2. The covering of the end of the effluent pipe from the disposal plant with rubbish, tends to interfere with the proper operation of the plant.
3. The dumping of refuse and garbage into the stream causes some of the refuse and garbage to be carried by the waters of the stream and creek down the creek and also causes the stream at places to flow under the dump.

I would, therefore, recommend that the local board of health be requested to take action to abate the nuisance by having the bed of the stream cleared of rubbish or by having a suitable covered culvert constructed through the dump, and also by adopting proper regulations for the dumping of refuse, copies of which should be posted at the dump and that such regulations be rigorously enforced. I would also recommend that a copy of this report be sent to the local board of health and that a statement of the action taken by the local board of health be sent to the complainant.

Respectfully submitted,
THEODORE HORTON,
Chief Engineer

ALBANY, N. Y., *June* 17, 1915

ENDICOTT

HERMANN M. BIGGS, M.D., *State Commissioner of Health:*

An inspection of the conditions of a swamp located in the western part of the village of Endicott, Broome county, was made on November 10, 1915.

A number of complaints of alleged insanitary conditions at the swamp due to the depositing of garbage near the swamp and to the discharge of tannery wastes into a stream which flows through it have been received. It was also alleged by the complainants that the swamp in question is a breeding place for mosquitoes and a menace to the health of the community.

The inspection of the swamp was made by Mr. C. A. Holmquist, assistant engineer in this Department in company with Dr. J. Edward Doig, health

officer of the village of Endicott. Dr. E. N. Christopher, health officer of the village of Union, which adjoins Endicott on the west, was also interviewed at the time of the inspection.

The swamp is located in the western part of the village of Endicott and extends into the village of Union. It has an area of about 20 acres. The territory in the vicinity of the swamp is being rapidly developed. A small stream which rises in the northerly part of the village of Endicott flows through the swamp and empties into the Susquehanna river near the westerly line of the village of Endicott. A 36-inch storm water sewer recently constructed by the village discharges into the easterly portion of the swamp and a channel has been constructed by the village from the end of the storm water sewer to the stream referred to.

One of the branches of this stream above the swamp flows through the tannery yard of the Endicott-Johnson Co., where it has been receiving seepage from certain tannary wastes dumped in the yard north of the tannery. The Endicott-Johnson Co. is now constructing an open concrete conduit for the portion of the creek which flows through their property and as the concrete sides of the conduit extend above the level of the ground it is probable that the stream will receive no more pollution from this source after the completion of the conduit.

The entire area of the swamp is very low having an elevation but slightly above the low water level in the creek which flows through it and only a few feet above the average dry weather level of the Susquehanna river. It was learned that during high water stages in the Susquehanna river the water from the river backs up in the small creek and floods the entire area of the swamp to a depth of three or four feet.

It was also found that during the spring of this year the high water condition of the Susquehanna river caused the backing up of the sewage in the outfall sewers of the village of Endicott which have been constructed through the swamp with the result that the sewage of one of the outfall sewers which also serves the tannery of the Endicott-Johnson Co. overflowed through the manhole into the swamp giving rise to very insanitary conditions in the swamp. The manholes in the swamp, however, have since been raised to an elevation above the maximum high water mark of the swamp.

About four weeks prior to the time of the inspection one of the outfall sewers of the city which serves the tannery was crushed and that until the sewer was repaired by the construction of a cast iron sewer around the crushed portion the sewage from this sewer was discharged into the stream which flows through the swamp. This in all probability gave rise to very insanitary conditions due to the large proportion of tannery wastes in the sewage. At the time of the inspection practically the entire section of the creek from the point of broken sewer to its mouth had been cleaned out and its banks covered with lime and there was little or no odor given off from the creek.

It was also found that a dump is located in the northeastern corner of the swamp. A lot owned by one of the property owners near the swamp was being filled with ashes and rubbish. There was more or less decayed vegetable matter or garbage mixed in with the ashes which gave rise to objectionable odors. This dump is located in close proximity to a number of houses and if dumping is to be continued special precaution should be taken to eliminate organic matter or garbage from the materials dumped and the dump should be kept covered with a top layer of soil.

All of the persons interviewed at the time of the inspection complained of the prevalence of mosquitoes. Although there had been no rain for some time prior to the inspection the swamp was wet and soggy and covered, with aquatic growths. It is probable therefore, that the conditions are favorable for the breeding of mosquitoes although this could not be determined definitely from our observations in the field owing to the lateness of the season when the inspection was made. The health officer of Endicott stated that since he came to the village in 1905 there had been no cases of malaria in the village which could be attributed to the swamp or which had been contracted in that vicinity.

It would, however, be to the interest of public health to have the swamp drained. In order to drain the swamp it would be necessary to clean out, widen and straighten the channel of the stream which flows through it and to construct lateral drainage ditches through the swamp tributary to the main stream. It would appear also that inasmuch as the swamp is subject to flooding by the river setting back in the stream, it would be necessary to construct a dam with a tide gate across the stream near the lower end of the swamp or to construct a dam to prevent the backing up of the river into the creek and a pumping station to pump the water from the creek over the dam during times of high water.

Sections 27 to 30 of the Public Health Law outline the steps to be taken in the removal of waters where mosquito larvæ breed. It appears from these sections that the expense of the removal of waters wherein mosquito larvæ breed, may be borne by the owners of the premises on which the breeding place is located or part or all of the expenses by the property owners benefited or in part, by the owners of the premises benefited and in part by the municipality where the premises are situated as may be determined by the local board of health. Inasmuch as this swamp is located in two municipalities and since very little benefit would be derived by draining a portion of the swamp in one municipality without draining the portion in the other, it would require the joint action of the local boards of health of Endicott and Union.

As a result of this inspection the following conclusions are reached:

1. That the large swamp situated in the western part of the village of Endicott and the eastern part of the village of Union is periodically flooded by the high water conditions of the Susquehanna river and in all probability constitutes a breeding place for mosquitoes.
2. That insanitary conditions of the swamp have been caused by sewage from the tannery wastes of the Endicott-Johnson Co., the overflowing of sewage from the manholes on the village sewer system and from a break in one of the main outfall sewers of the village.
3. That these insanitary conditions have been or are being remedied.
4. That insanitary conditions are caused by the disposal of garbage and organic matter on the ash dump in the northeastern section of the swamp.

I would, therefore, make the following recommendations:

1. That if the local boards of health determine definitely that this swamp constitutes a breeding place for mosquitoes and gives rise to a nuisance or a danger or injury to life or health steps should be taken to have the swamp drained in accordance with the provisions of sections 27 to 30 of the Public Health Law.
2. That the local board of health should take steps to prevent the dumping of garbage on the dump in the northeastern section of the swamp and to require that the dump be covered with soil.

Respectfully submitted,
THEODORE HORTON,
Chief Engineer

ALBANY, N. Y., *November* 29, 1915

ROTTERDAM (town)

HERMANN M. BIGGS, M.D., *State Commissioner of Health:*

An investigation of the drainage of certain lands in the town of Rotterdam, Schenectady county, was made at the request of the local Board of Health on July 1, 1915, by Mr. C. A. Howland, inspecting engineer, in company with Dr. C. W. Ensign, town health officer; John H. Veeder, town supervisor, and the following members of the board of health, Justices C. H. Knight, Charles Loeber, Peter Van Dyke and John Laden.

The parcel of land which is owned jointly by Mr. Isaac L. Hotaling, address 965 State street, Schenectady, and Mr. Emett Blessing of the same city, is situated in the southeastern part of the town of Rotterdam between the Albany-Schenectady turnpike and Albany street in an easterly direction from the station at Stop 5. The inspecting engineer was informed that complaints have been received by the local board of health from residents of the neighborhood for a number of years in regard to the stagnation of water on this land and its use as a disposal place for refuse. Notices, ordering abatement, have been served by the local board of health, which declared the conditions to constitute a nuisance, but no permanent relief had yet been obtained and it was in connection with further action in the matter that the assistance of this Department has been requested.

The section in which the parcel is situated is a purely residential one having no public water supply or sewerage system. A considerable number of houses are so located as to be affected by odors arising from this land or by mosquitoes breeding on it. The parcel consists of about 3½ acres grown up with bushes, grass, rushes, etc., and the surface slopes toward the southwesterly corner, where a pond of water had accumulated. This pond was draining through a ditch to a 2 feet by 3 feet culvert passing diagonally under Albany street and connecting with a 2 feet tile sewer which passes westerly along Albany street and discharges into a stream.

At the time of the inspection it was obvious that the land was draining, but considerable rain had recently fallen increasing the amount and depth of water. A pool of water lay in the road ditch just above the culvert. The engineer was informed that the further or southerly end of the culvert had been lowered by the town authorities. The investigation, which it was possible to make, indicates that it would not be practicable to completely drain the land through the present culvert and sewer but the use of precise instruments would be necessary to establish this beyond question.

The lots immediately adjoining to the west have been filled in and built upon and this fill, it was stated, has obliterated the natural drainage course of the land. The engineer was informed that a stream passed directly across the road and flowed southerly but the owners of the property to the south of Albany street supplied the pipe which was used by the town to divert the water to the stream to the west.

The data gathered during this investigation indicates that this land forms a breeding place for mosquitoes, which are abundant in the neighborhood and is, therefore, a menace to the public health. The numerous frogs found there and swarms of flies together with the odors rising from stagnant water are objectionable. It is obvious, therefore, that these conditions should be abated.

Two methods suggest themselves, namely, to drain the land without disturbing the present surface elevations or to fill it in. Of the two, the former would be much the cheaper if it could be accomplished without disturbing the culvert and sewer but if it becomes necessary to not only lower these but to carry the outlet further down stream to get greater fall, the cost will be materially increased. The 3½ acres could probably be ditched and drained to the culvert for less than $200 but as previously stated the culvert and sewer will probably not drain it off.

The land in the immediate vicinity has been filled in before it has been built upon and as parts of the marshy land lie at an elevation lower than the road and lower than the adjoining property it would seem desirous that this should also be filled in, which if done properly would remove the objectionable conditions. Assuming that material for filling can be obtained at the cost of loosening, loading and hauling and that a haul of one-half mile is necessary, one acre could be filled in to a depth of 1 foot for a cost which will probably not exceed $600.

However, the cost can be more accurately determined with more complete data and there are also legal questions of possible damage to property by the diversion of water from its natural course and of the apportionment of the cost of the work. These questions can best be settled by proceeding under the provisions of section 27 and following sections of the Public Health Law

which direct that the procedure of drainage shall be carried out as defined in the Drainage Law, which is chapter 15 of the Consolidated Laws.

I would, therefore, recommend that a copy of this report be transmitted to the local board of health and that they be urged to proceed at once under the above provisions of the Public Health and Drainage Law.

I would also recommend that a copy of the report be transmitted to the owners of the property.

Respectfully submitted,
THEODORE HORTON,
Chief Engineer

ALBANY, N. Y., *July* 10, 1915

SCHENECTADY

HERMANN M. BIGGS, M.D., *State Commissioner of Health:*

An investigation was made in regard to an alleged nuisance in the city of Schenectady arising from a dump, in the so called Pleasant Valley Park, near a residential section on September 24, 1915, by Mr. C. A. Howland, inspecting engineer, pursuant to a complaint signed by some 83 residents of Schenectady.

The records of this Department show that a number of complaints have been received in regard to the dumps used by the city of Schenectady for the disposal of refuse and that investigations have previously been made by representatives of the Department. An order of abatement of nuisance was served upon the Commissioner of Public Works in regard to the Wendell dump under date of August 20, 1915.

The engineer conferred with Dr. J. L. Schoolcraft, health officer of Schenectady and was informed by him that the rubbish and ashes of the city are collected by contract and disposed of on some 5 dumps of which the one complained of is one of the most important. The garbage of the city is also collected under contract and disposed of by reduction in the city garbage reduction plant. It appears that a dump can be used only with the consent of the owners of the dump and by permission of the Bureau of Health of the Department of Public Safety. All of the dumps with the exception of the one about which the complaint is made are owned by private individuals. The land on which this dump is located was purchased by the city to be used as a park.

The dump about which the present complaint is made is the Craig street dump and the health officer has from time to time taken action to prevent the dumping of garbage on this dump or the creation of a nuisance through dumping the material too near the street. Trouble has been experienced with private individuals, restaurant keepers, butchers, etc., who dump garbage on the dump surreptitiously. The inspector of the Bureau of Health inspects the dumps, each one being visited at least once every two weeks. The Department of Public Works also employs a man who endeavors to keep away such persons as intend to dump putrescible organic matter.

In company with Dr. Schoolcraft and with Mr. Wm. Chadsey, Deputy Superintendent of Public Works, the engineer visited the Craig street dump. This dump is located upon a steep side of a ravine, which runs parallel to Strong street and the entrance to the dump is at a point opposite Craig street. The engineer was informed by Mr. Chadsey that it was intended to construct a roadway across the dump to the Mt. Pleasant section of the city and that it was estimated that about 4 years would be necessary to build up the road with refuse so that it would have a 6 per cent. grade from both sides of the ravine. However, residents of the Mt. Pleasant section, believing that the proposed work would be detrimental to that section obtained an injunction restraining the construction and this injunction is to be returned during the week of September 27. It is intended that the dumping shall be carried on at a point about 200 feet from the street but

at the time of the inspection it was found that considerable material had been dumped nearer Strong street. This dump is used by the city only on Monday, Tuesday and Wednesday, about 24 loads of 5 cubic yards each or a total of 120 cubic yards per week, being dumped there.

Under the ordinances of the city of Schenectady the contractor is required to cover all material. A large part of the material, however, was not covered although considerable earth was available which could have been used for that purpose. It was not found that any considerable amounts of garbage had been dumped there although putrescible organic matter is contained in the street sweepings which are disposed of by the Department of Public Works and in the grit removed from catch basins. The city requires that garbage and refuse shall be separated by the property owners before collection and a section of the Housing Code of the city of Schenectady provides that after January 1, 1916, separate receptacles must be provided by the occupants of every dwelling for "ashes, rubbish, garbage, refuse and other matter." At the present time the separation of the garbage from the refuse is successfully accompilshed in a considerable portion of the city.

It will be seen from the above description that the dump is located in such a way that houses are near it only on one side, including houses on Strong and Craig street, and these are small houses occupied by people of the laboring class. The engineer talked with a number of the residents of the section and it was alleged that odors arising from the dump are obnoxious in the neighborhood. Mention was also made of the surreptitious dumping of garbage on the dump and of the depreciation to property said to be due to its proximity.

From the above inspection it appears that the disposing of refuse, ashes and garbage in the city of Schenectady is a matter which has been the subject of many complaints. The garbage is apparently adequately disposed of in the city reduction plant and therefore nuisances which arise are apparently caused by individuals who dump putrescible organic matters on the dumps without the knowledge or permission of the city authorities. The city has apparently taken repeated action to prevent the creation of a nuisance by the use of these dumps but has met with only partial success. It would seem that unless great care is taken to carefully cover the refuse matter and to dispose of it in locations situated as far as possible from residential sections public nuisances will continually arise. At the time of the inspection there did not appear to be a sign posted at this dump to warn people against dumping garbage or other matters on the dump.

I therefore beg to recommend that the city authorities of Schenectady be advised to adopt a system for the permanent disposal of all refuse matters either incineration or some other method whereby the refuse shall be removed to some isolated location. I would recommend further that, the city authorities of Schenectady be advised that, until such a system of refuse disposal be adopted, they prevent the dumping of putrescible organic matters on these dumps by careful supervision and by increased vigilance and require that the dumps be maintained by covering and proper disposition of the refuse, in such a condition that public nuisances will not be created.

Respectfully submitted,

THEODORE HORTON,

Chief Engineer

ALBANY, N. Y., *September* 29, 1915

TROY

HERMANN M. BIGGS, M.D., *State Commissioner of Health:*

An inspection of the Fat Melting & Calf Skin Association rendering plant in the city of Troy, Rensselaer county, was made on March 3 and 4, 1915, by C. A. Howland, assistant engineer, at the request of Dr. O. R. Eichel, sanitary supervisor, to whom the matter had been referred.

A resident of Troy who owns property near the rendering plant complained to this Department in person in August, 1914. The matter was taken up with the Troy bureau of health through the health officer, who informed the Department, over the telephone, that a nuisance is not created by the operation of the plant and requested that an inspection be made. A request for an inspection was also recently made by the attorney for the rendering company. The health officer of the city was asked to make written request for this inspection but such request has not been made.

The engineer conferred with Dr. C. E. Nichols, health officer of the city of Troy, who informed him that since 1906 repeated complaints have been made to the local bureau of health. The rendering plant has been repeatedly inspected by representatives of the Troy bureau of health and it was always found that there was no cause for complaint. Recent inspections were made on Aug. 6, 1913, June 15, 1914, and July 21, 1914. The rendering plant is operated under a permit from the Troy board of health granted in accordance with the provisions of section 36 of the Rules and Regulations of said board, adopted May 18, 1893.

Subsequent to the receipt of a petition, which the engineer was later informed had been signed by 700 or 800 persons, the common council of the city passed resolutions, notices were served on the rendering company and on the health officer in accordance with section 31 of article 3 of the Public Health Law and an action to prevent a public nuisance has been started in court by the city council.

The Fat Melting and Calf Skin Association is an association of about 150 market men of Troy, Albany, Watervliet, Cohoes, Waterford and Mechanicville. The officers of the association are as follows:

President, J. J. Moran, 2282 5th avenue, Troy.
Vice-President, Henry Wagner, 66 Bassett street, Albany.
Treasurer, Pat. E. Delee, 152 4th street, Troy.
Secretary, J. H. Ludlum, Albany.
Manager, Wm. H. Ryan.
Bookkeeper, Geo. H. Welch.

The rendering plant is located on Spring avenue in the south end of Troy, close to the south bank of Poesten Kill. Spring avenue has been recently paved and there is considerable traffic over it. The section immediately surrounding the plant is not closely built up. Between the plant and the Kill is a blacksmith shop while on the other side of the plant are some buildings belonging to the Stoll Brewing Company, whose brewery is situated directly across the street. Some of the brewery buildings are used as residences. Between the buildings on the south and Linden avenue, which is about 350 feet distant, are two residences. The ground surface rises abruptly on the south and north sides of the Kill and few houses have been built on these hills. Spring avenue north of the Kill, and Hill street for a short distance above Spring avenue, are solidly built up. The few remaining houses on Hill street are scattered. A large part of the south bank of the creek is occupied by the Ruff Feed Mill. The nearest occupied building is the blacksmith shop which adjoins the rendering plant. The brewery offices across the street are about 50 feet distant.

The building, in which the rendering is done, is a brick structure consisting of three stories and basement. In the rear are located stables and an attached building, the concrete cellar of which is used to store hides. The main building is used for rendering and also for storing butchers' supplies. The raw material, which is rendered, consists of bones, suet, and fat from meat markets, grease from hotels and restaurants and carcasses of animals including horses, dogs and cats. Collections of market scraps are made in wagons, divided into compartments each one of which has a cover. The dead horses are brought in wagons covered with heavy canvas.

The following table indicates the volume of raw material received per month at different periods of the year:

Raw Material

1914	Market Scraps
May	142,422 lbs.
June	148,943 lbs.
July	140,554 lbs.
1915	
January	115,769 lbs.
February	101,012 lbs.

1915	Horses	Dogs	Cats
July	74	164	159
September	72	88	93

An elevator outside of the rear of the building is used to raise the scraps and grease to the third floor. Horses are taken to the same floor by an outside lift and are skinned and cut up there. The engineer who observed this operation, found that if the precautions taken at that time are always observed a disagreeable odor will arise only when the abdomen is opened. At the time of the inspection the odor arising at that time was not sufficient to be noticed at any considerable distance. The engineer was informed that collections of scraps, etc., are made daily and the scraps which the engineer saw were fresh. The horses are skinned and cut up practically as soon as received and if as claimed the association sends immediately for horses it is not probable that animals in an advanced stage of putrefaction are received.

All of the raw material received during the day is put into one of the rendering tanks through shutes connected with circular openings in the floor of the third story. The two rendering tanks are large cylindrical tanks with their upper ends just above the floor of the second story and extending into the first story.

The method of operation, practically all steps of which were observed by the engineer, is as follows:

The tank to be used is charged during the day and late in the afternoon the charging door and discharging door are tightly closed. About 50 pounds per square inch of steam pressure is used to cook the material for about six hours. In order to prevent the escape of obnoxious odors into the air the tanks have been fitted with 1½-inch leaded iron pipe which leads from the top of the tank to the fire box of the furnace. A valve in these pipes is opened one-quarter turn during the cooking. When the cooking is completed the steam is turned off but the exhaust valve is still left open until the pressure as shown by the pressure gauge has decreased to zero. This takes about three hours. The tank remains for about two hours longer when the top is opened and the water is drawn off. The grease is drawn off into a separator from which it flows into a cooler where it remains 24 hours. The tankage is then washed several times until the water is clear and is then discharged through a hole in the floor of the first story into a large wooden bin in the cellar.

From the bin the tankage is shovelled into a hydraulic press where a large part of the water is pressed out and it is then placed in the dryer where it is thoroughly dried. The heat for the dryer is furnished by coils of steam pipes and the vapors arising from the process are drawn off through an exhaust conduit of wood by an exhaust fan and discharged into the fire box of the furnace. At the time of the inspection this exhaust conduit leaked at the top and the engineer was informed that this leakage at the top occurred around removable sections provided to allow the conduit to be cleaned. The steam has the characteristic odor of tankage but at the time of the inspection was not escaping in sufficient quantity to be noticed outside of the building.

When the tankage is dumped a considerable amount of steam arises and this has an odor which is objectionable to one not accustomed to it. A fan has been placed in the side of the elevator shaft, which extends to an outlet

on the roof. This fan, which is 30 inches in diameter and is rated as being capable of exhausting some 7,660 cubic feet of air per minute, is evidently of sufficient size to properly exhaust the steam from the basement but at the time of the inspection the engineer observed that this fan was not in operation during the dumping when the accumulation of steam was greatest in the basement. The fan is run by the same engine that runs the drier.

A study of the process would indicate that with the apparatus in proper working order there is little opportunity during the cooking for gases to escape into the air. Unless an insufficient fire to properly consume the gases is maintained in the fire box of the furnace or the packing of the different doors is defective or the pipe joints leaky, obnoxious odors will not escape. At the time of the inspection the charging door of the tank, which is packed with a lead gasket, leaked slightly.

The wash water from the floors passes down through a main waste pipe, which discharges in a channel in the concrete floor of the basement. The wash water when the tankage is washed also discharged into this channel. When the tankage is pressed the liquids pass across the floor into this channel. The channel discharges into a settling tank 7 feet by 4½ feet by about 3 feet deep into which cold water is discharged to coagulate the grease. The grease rises to the top and is skimmed off to be again cooked in the rendering tank. A tile pipe near the bottom fitted with a valve, discharges the contents of the settling tank into a small pit from which it flows into the sewer. The sewer outlet is apparently not trapped. An emergency overflow is also provided.

In order to obtain some estimation of the amount of the wastes which are discharged through the sewer the engineer obtained the following figures in regard to the water consumption:

Water Consumption

From	To	Gallons used	Approximate average daily consumption
Nov. 1, 1913	Feb. 1, 1914	613,403	6,660
Feb. 1, 1914	May 1, 1914	426,390	4,790
May 1, 1914	Aug. 1, 1914	538,597	5,859
Aug. 1, 1914	Nov. 1, 1914	533,735	5,840
Total for year		2,112,125	5,790

Products Sold

The volume of the products may be obtained from the following figures:

1914	Tallow	Tankage
June	78,772 lbs.	58,702 lbs.
July	45,527 lbs.	1,528 lbs.
1915		
January	70,682 lbs.	57,600 lbs.
February	42,569 lbs.	none.

The engineer made a thorough inspection of the neighborhood and interviewed a number of persons who live or work nearby. Mr. Paul Frank, who occupies the house next east of the rendering plant, stated that at times the odor coming from the rendering plant is decidedly obnoxious. This odor is worse at night and in the morning and can be noticed every day in hot weather. He also stated that after a complaint has been made the odor is not noticed for a time. Mr. Charles J. Albert, Assistant Manager of the Stoll Brewery, informed the inspector that he had noticed an obnoxious odor repeatedly. Mrs. Chas. Duncan and Miss B. Sheridan also informed the

inspector that they had noticed obnoxious odors coming from the rendering plant.

It was stated by nearly all those interviewed that these odors were noticed in the evening and that they disappeared when a complaint was made.

At the time of the inspection nearly all of the windows of the plant were closed and apparently every precaution was taken to prevent the escape of obnoxious odors. Although the engineer repeatedly made observations in the surrounding neighborhood so that he would have noticed any odor, none was observed at that time. It is therefore apparent, that with proper care and precautions the plant can be operated, at least at this time of the year, in such a manner that odors, which may be said to constitute a public nuisance, will not arise. It is also obvious that any carelessness in the operation of the plant or any neglect to keep the apparatus in proper repair will result in the creation of a public nuisance.

In conclusion, the following points may be indicated as requiring attention. When the tankage is dumped considerable steam arises and although a fan is provided to exhaust this steam into the elevator shaft, the fan, which is run by the engine that operates the drier, was not started until after the tankage had been dumped. At the time of the inspection, the steam arising from the dumped tankage could not be said to cause conditions of public nuisance outside of the building but there is a possibility that at other times of the year and under other atmospheric conditions a nuisance will be created.

It was also found that the duct installed to convey the steam from the drier to the fire box leaked at the top and this should evidently be kept tight although the volume of steam which escaped was small in comparison with the volume which arose when the tankage was dumped. It was also found that the charging door of the tank in use at that time leaked slightly during the cooking. These doors should be kept tight.

I would therefore recommend that the local bureau of health of the city of Troy be informed of the results of this investigation and that they be advised to require that the rendering plant of the Fat Melting and Calf Skin Association be operated in such a manner that a public nuisance will be prevented at all times of the year. I would recommend further that copies of this report be transmitted to the Bureau of Health of the city of Troy and to the Fat Melting and Calf Skin Association.

Respectfully submitted,

THEODORE HORTON,
Chief Engineer

ALBANY, N. Y., *March* 29, 1915

TROY

HERMANN M. BIGGS, M.D., *State Commissioner of Health:*

An inspection was made of a municipal dumping ground of the city of Troy located in the northern or Lansingburg section of the city on May 12, 1915.

The records of this Department show that complaints have previously been received in regard to this dumping ground and that, on September 11, 1913, an inspection was made as the result of such complaints. In the report upon this inspection, it was shown that the conditions should be remedied and steps toward this end were indicated. Several complaints having been recently received, Dr. O. R. Eichel, sanitary district supervisor, visited the dumping ground and the inspection described in this report was made at his request on May 12, 1915, by Mr. C. A. Howland, assistant engineer.

The North End or Lansingburg dumping ground of the city of Troy is located approximately between Third and Eighth streets and Sixth avenue

and the Boston and Maine railroad tracks. The area principally consists of a poorly drained section of marshy land tributary to a small stream called Gould's creek. This creek rises in lakes located in Oakwood cemetery and enters the marshy area at its northern end. There is but little fall between the northern end and Second street at which point the stream drains into a four-foot brick sewer discharging into the Hudson river.

The section south and west of the dumping ground is largely residential and buildings in the course of construction indicated growth. North of the dumping ground is the Rensselaer park race track, while to the eastward the ground rises steeply to Oakwood cemetery.

It was found, at the time of the inspection, that the largest part of the refuse deposited on this dumping ground consisted of inorganic wastes such as ashes, metals, crockery, paper, etc., but it was also found that garbage had been deposited at several points about the dump. Several loads were observed at the northern end and others near the central part and southern end. The relative proportion of garbage to ashes indicated that the garbage for the whole section is not disposed of there and the garbage and ashes were not mixed in the loads. Some of this garbage, which was covered by swarms of flies, was in an advanced state of putrefaction and gave off a foul odor.

Under a wooden bridge which crosses the outlet stream at Third street, sewage is discharged from about six houses. As the water is practically stagnant at this point, the fecal wastes accumulate and putrefy, giving off offensive odors which would affect persons passing on the street and also persons residing in nearby houses, the nearest of which is about eighty feet distant.

The engineer called at the offices of the bureau of health of the city of Troy where he was informed that several complaints had been received by the bureau during the past year in regard to the Lansingburg dumping ground, but that it had been invariably found upon inspection that there was no cause for complaint. It also appears that it is necessary for the department of public works of Troy to obtain a permit from the board of health to establish a dumping ground.

Mr. Charles F. Crowley, commissioner of public works of Troy, informed the engineer that the garbage and refuse of the Lansingburg section were collected separately and that the North End dump is for the dumping of refuse exclusive of garbage. From the records of the department of public works, it appears that from 540 to 600 loads of refuse are deposited on this dump per month. Mr. Crowley also informed the engineer that negotiations had been in progress for some time between the city of Troy and the C. O. Bartlett and Snow Co. of Cleveland, Ohio, in regard to the installation of a reduction plant to treat the city garbage and dead animals and that the matter had been delayed only to obtain a satisfactory site. From the contract submitted by the company, which is included in the minutes of the board of contract and supply for March 23, 1915, it appears that the company proposes to install a plant of the type known as the Cobwell Sanitary System and to dispose of the garbage therein for the sum of $5,000 annually.

The engineer also talked with Mr. Alfred E. Roche, city engineer of Troy, who investigated the location of the dump with reference to sewering the section. The report of the city engineer is contained in the minutes of the common council for November 19, 1914. As a result of his investigation, the city engineer recommended that the water of Gould's creek be intercepted and discharged into the Hudson river by a sewer along Eleventh street, which would also receive lateral sewers from the northern part of the area in question. The existing sewer in Second street would be continued to form a trunk sewer which, by means of laterals, would drain the remainder of the area. As the elevation of the sewer at Second street is fixed, it was found that, in order to obtain proper grades in the sewers, it would be necessary to place their upper ends at an elevation above the present ground surface. The city engineer, therefore, recommended that the location be further filled in with ashes for a period of seven or eight years.

From the above inspection, it appears that the Lansingburg refuse dump

in the northern part of Troy is situated close to a built-up residential section and that obnoxious odors arising from this dump will, under certain atmospheric conditions, create a public nuisance affecting a considerable number of persons. It is, therefore, important that putrescible matters such as garbage should not be deposited on this dump and that care should be used in depositing other nonputrescible wastes in order that conditions of nuisance may not be created through the blowing about of the wastes. The neighborhood shows indications of growth and, if buildings should be erected close to the dump, it may be necessary to abandon it.

It would seem advantageous that this low land, with its stagnant pools which afford breeding places for mosquitoes, be filled in but, as pointed out in a previous report, it will be necessary to make some disposition of the water now discharged onto it through Gould's creek and also of the storm water which accumulates on its surface. The work of filling in should be carried forward in such a way as to prevent a nuisance.

The sewage which is at present discharged into the stream at Third street should be disposed of in some other manner which will not, like the present method, create a public nuisance and endanger the health of the community.

Summarizing briefly, it will be seen from the above that conditions of public nuisance are created in the vicinity of this dump:

1. By the deposit of garbage mixed with refuse.
2. By improper disposition of sewage in the vicinity of Third street.
3. By the swampy conditions and prevalence of mosquitoes in the district.

These causes of insanitary conditions in the district can be remedied by prohibiting and strictly enforcing rules against the deposit of garbage on the dump; by insuring proper separation of garbage and refuse before it is collected through the exercise of sanitary and police authority; by providing sewerage facilities for the district, especially in the vicinity of Third street; and by proceeding as rapidly as possible with the filling in or proper drainage of the swampy portions.

In view of the above and in consideration of the fact that repeated complaints have been received at this Department of the insanitary conditions existing in the vicinity of this dump and of the results of the investigations made by the Department, I would recommend that the city authorities be urged to take steps to abate the conditions of nuisance now existing and, if adequate means are not adopted within a reasonable time to this end, that consideration be given to the issuance of an order directed to the city authorities requiring them to abate the public nuisance now existing.

Respectfully submitted,

THEODORE HORTON,
Chief Engineer

ALBANY, N. Y., *May* 17, 1915

In addition to the foregoing, inspections were made or advice given through correspondence in matters relating to nuisances at the following places:

Akron,
Amherst,
Andover,
Beacon,
Belfast,
Binghamton,
Cattaraugus,
Central Bridge,
Central Valley,
Chappaqua,
Cleveland,
Dundee,
Franklin,
Fulton,
Gardenville,
Gates,
Geneva,
Granite Springs,
Hancock,
Holland,
Holley,
Ithaca,
Kingston,
Kirkville,
Lockport,
Margaretville,
Montgomery,
New City,
New Rochelle,
Niagara Falls,
Ontario Center,
Oyster Bay,
Parksville,
Port Chester,
Poughkeepsie (town)
Randolph,
Rye,
Scarsdale,
Schaghticoke,
Ulster,
Walden,
Watervliet,
West Seneca,
Williamson.

INVESTIGATIONS ORDERED BY THE GOVERNOR

INVESTIGATIONS ORDERED BY THE GOVERNOR

Under the provisions of section 6 of the Public Health Law, examinations into nuisances or questions affecting the security of life and health in any locality may be required of the State Commissioner of Health by executive order. One such investigation was requested by the Governor in reference to the alleged public nuisance affecting residents of Riverside drive, New York City, and arising from the operation of certain industrial establishments at Edgewater, New Jersey, on the west shore of the Hudson river. A careful inspection was made of these manufacturing plants and the following report submitted to the Governor setting forth the results of this examination and of observations made with reference to the effect of the operations at the plants in creating conditions of nuisance in New York City.

Hon. CHARLES S. WHITMAN, *Governor, State of New York, Albany, N. Y.:*

DEAR SIR.— Pursuant to your order dated October 4, 1915, requiring me to make an examination into the matters alleged in the complaint of residents of the county of New York, that certain extensive manufacturing plants located within the State of New Jersey, at Edgewater, are constantly generating and causing to be discharged over the territory comprising New York county, and particularly the part thereof adjacent to Riverside drive, vast quantities of noisome and disagreeable smoke, fumes, effluvia, noxious and poisonous vapors and gases which injure and endanger the comfort, repose, health or safety and property of a considerable number of persons, citizens of New York county; and into the questions affecting the security of life and health in the locality aforesaid in the county of New York, and to report the results thereof to you on or before the first day of November, 1915, I have the honor to report as follows:

A previous investigation of the conditions of operation of many of these plants was made by this Department in 1913, at the request of the Attorney-General of the State, based upon complaints of residents of the Riverside drive section of New York city, who alleged substantially the same objectionable conditions as those now complained of and referred to in your order of October 4, 1915. This former investigation covered four days of continuous observation in the month of October, 1913, during which time a careful inspection of some nine of the manufacturing plants at Edgewater was made and the effect of their operations upon the comfort and health of residents of the Riverside drive section of New York city carefully observed. A report dated December 1, 1913, covering this investigation, was submitted to the State Commissioner of Health and duly transmitted to the Attorney-General on December 16, 1913, the conclusions of which were, briefly stated, substantially to the effect that, while the operations of certain of the plants in operation at Edgewater at that time were such as to produce objectionable odors, fumes and gases which were offensive and stifling near these plants and which could be detected across the river when the wind was westerly, yet they were not, at the time of the investigation and under the conditions of observation, such as to create a nuisance in the city of New York; but

that, under certain other atmospheric and other conditions, objectionable and possibly injurious conditions might and in all probability would be created in New York city opposite these plants.

Immediately upon receipt of your order of October 4, an investigation was undertaken to determine more definitely the nature of operations carried on in these plants and the extent and character of any gases, fumes or other objectionable odors arising from them which might affect the comfort and health of persons residing in New York county, and as to the absolute extent and relative share which any of these plants might have in the creation of a nuisance or menace to health of said residents. Owing to the brief time available for this investigation, it was not deemed practicable to extend the scope of my investigation beyond that of a careful inspection of the plants and careful field observations.

One assistant engineer, the chief sanitary inspector and two inspectors were accordingly at once detailed to make these inspections and to carry on the field work referred to and, through the courtesy of the State authorities of New Jersey and the management of the various plants, free access was obtained to the various manufacturing plants and a most careful inspection, covering some four or five days, was made of all of the plants, including the various operations carried on within them in their relation to any noxious gases, smoke, fumes and odors that might possibly arise from them. During the entire period covered by the investigation, from October 7 to October 27, inclusive, continuous observations were made in the field daily, and during a portion of many nights, in the Riverside drive section of New York county, alleged to be affected, and a complete record or log of these observations was kept. The nature and extent of our inspections and field observations comprised:

1. Observations in and about each of the plants in order to determine and differentiate the individual or composite nature and intensity of any gases, fumes, smoke or odors that were generated and emitted.

2. Observations of the character and intensity of any of these gases, fumes, smoke and odors emitted from the plants at different distances from the plants under varying conditions of wind direction and other atmospheric conditions in order to determine which of them were carried by the atmosphere and could be detected at any appreciable distance from the plants; to determine the extent of reduction in the intensity of any gases, fumes and odors emanating from these plants as the distances from the plants increased; and finally to determine the limiting distance to which any noxious gases, fumes, smoke or odors from any of the plants could be detected.

3. Observations at various points along the water front in New York county, opposite Edgewater, to determine the absolute and relative character, intensity and effect of any gases, fumes, smoke or odors when the wind and atmospheric conditions were such as to carry these gases, fumes, smoke or odors across the Hudson river onto New York county.

4. Local daily field observations and a study of records of the Weather Bureau at Central Park, with reference to wind, meteorological conditions, such as humidity and barometric pressure, precipitation, etc., in order to determine the atmospheric conditions under which any gases, fumes, smoke or odors might be detected and, particularly, to determine the frequency and total time during which any objectionable odors of gases, fumes, smoke, etc., or any nuisance or menace to health arising therefrom, might prevail in the section of the county of New York referred to.

A description of the various plants located in Edgewater, New Jersey, which it was considered might be in any way responsible for the conditions in the allegations of these complaints, with their locations and the character of the operations carried on within them, and the nature of any gases, fumes, smoke or odors which were emitted from them, together with any changes in the construction or conditions of operation of these plants, as compared with the previous investigation of 1913, above referred to, will now be given, the location of each being shown and designated upon the accompanying map.

Public Service Electric Company

A power plant of this company is located immediately west of the ferry in the northern part of Edgewater, approximately opposite One Hundred and Thirty-fifth street, New York city. The plant is a standby station of the Public Service Electric Company and is used to generate electricity for the street railway service of the company in case of emergency or during peak loads. There are eight boilers in this plant, having a combined horse power of 2,600. From seven to twenty-five tons of soft coal are burned per day when the station is in operation. The boilers are hand-fired and give off considerable black smoke when the plant is in active use.

Warner Sugar Refining Company

This plant is located a few hundred feet south of the ferry at Edgewater, opposite One Hundred and Thirtieth street, New York city. The operations carried on at this plant consist of refining raw sugar by washing, melting, filtering, crystallizing and drying. No objectionable odors were noticed in or about this plant. There was, however, a peculiar characteristic furnace odor in the bone-black or char department, but this odor was not noticed outside of the building in which the bone-black is revivified.

Both soft and hard coal are used at this plant. The soft coal is used under boilers provided with mechanical stokers and hard coal under the hand-fired boilers. Comparatively little smoke issued from the stacks of the power plant, except for a few minutes at a time when the boilers were being stoked.

Sinclair and Valentine Company

This company is located west of the Warner Sugar Refining Company and is engaged in the manufacture of printing inks. The principal ingredients used are linseed oil and aniline dyes. The processes of manufacture consist chiefly of mixing, precipitating, pressing and grinding of the colors and other ingredients.

A varnish is also made at this plant for use in making printing ink. It is prepared by heating the linseed oil in kettles, to a temperature of about 500 degrees Fahrenheit, until a varnish of the desired quality is produced. The exits from the boiling kettles are all connected with a metal pipe which leads to an oven or vapor consumer located above the kettles where the oil vapors given off by heating linseed oil are burned with fuel oil at a temperature said to be about 2,500 degrees Fahrenheit. The exit from the vapor consumer connects with the 100-foot brick stack of the boiler plant through a brick-lined iron conduit. The combustion in the vapor consumer appeared to be complete and only a comparatively slight peculiar or characteristic linseed oil odor was noticed in the plant.

Both hard and soft coal, mixed in the proportion of two parts of hard coal to one part of soft coal, was used in the boiler plant. Comparatively little smoke was seen coming from the stack, except at the time when the boilers were stoked.

Batterson & Eisle

This plant is located immediately south of the Warner Sugar Refining Company and is engaged in the manufacture, sawing and polishing of marble. All of the sawing and polishing is done with the use of water, and there was no dust noticed in or about the plant. About five tons of soft coal are used at the boiler plant per day. The boilers are hand-fired, but comparatively little smoke was seen escaping from the stack.

Valvoline Oil Company

This plant is located about one-half mile south of the Warner Sugar Refining Company, opposite One Hundred and Nineteenth street, New York city, and is employed in the manufacture of different grades of lubricating

oils and greases. No crude oils are refined at this plant and the processes of manufacture consist largely of the further refining of partially refined oils and, in some cases, the combining of them with animal oil. A peculiar characteristic oil refinery odor was noticed in and about the plant, more especially near the bone-black revivifying plant where the residual oil in the bone-black, through which the lubricating oils are filtered, is burned out by heating to a cherry red in furnaces heated with fuel oil. This burns out the residual oil in the bone-black and the oil vapors which are not consumed in the furnace are discharged into the atmosphere through three metal stacks. The oil vapors from these exits are bluish-white and seem to carry a long distance before they are dispersed. Both soft and hard coal, mixed in the proportion of one part of hard to one part of soft coal, are used at the boiler plant. Comparatively little smoke was seen issuing from the stack of the boiler plant.

Midland Linseed Products Company

This plant is located south and southwest of the Valvoline Oil Company, opposite One Hundred and Seventeenth street, New York city. Different grades of linseed oils are made from flaxseed at this plant. The processes of manufacture consist chiefly of cleaning, grinding, heating and pressing the seed to extract the oil. Some of the oil is further concentrated by heating, which increases its specific gravity, and a portion of the oil is refined.

There was a decided characteristic linseed oil odor in the different buildings, and this odor could be noticed at a considerable distance to the leeward of the plant. Ninety per cent. hard coal, mixed with 10 per cent. soft coal, is used at the boiler plant. Comparatively little smoke is discharged through the stacks, except during the stoking of the boilers.

Coal yard of the New York, Susquehanna and Western Division of the Erie railroad

This yard is located south of the Midland Linseed Products Company, opposite One Hundred and Tenth street, New York city. Hard coal shipped from the mines is stored and loaded on barges or boats at this yard. In addition to a boiler plant, used to generate power to operate hoists and buckets, which uses about thirty tons of hard coal a day, there are some seven or eight locomotives in the yard, each burning about ten tons of coal per day. It was found that some of the locomotives use soft coal and others hard coal and some a mixture of soft and hard coal. Considerable volumes of smoke were discharged from the stacks of the locomotives in the yard.

The coal storage yards of the New York Edison Co.

This yard is located opposite One Hundred and Sixth street, New York city, and is used to store the reserve or surplus coal of the New York Edison Company. Two or three derricks operate in this yard, but very little smoke is given off from the boiler plants furnishing power for the derricks.

Corn Products Refining Company

This plant is located immediately south of the coal storage yard of the New York Edison Company, opposite One Hundred and Fourth street, New York city. Starch, glucose, corn oil, grape sugar and various other corn products are made at this plant. The processes of manufacture of the principal products are briefly as follows:

Corn received at the plant is first cleaned and then soaked in water containing sulphurous acid for the purpose of softening the kernel. After steeping, the corn is passed through cracker mills, where it is partially

crushed and the germ removed from the body of the corn. The germ is separated from the remainder of the corn by gravity in tanks, is then dried, ground, heated and pressed to produce corn oil and cake. The corn from which the germ has been removed is then ground in buhrstone mills and the mixture is washed and passed through fine mesh reels a number of times in order to remove the sulphurous acid and separate the starch from the gluten and other fibrous matters. The gluten and fibrous matters are passed through mechanical squeezers to remove the water, after which they are dried in rotary steam-heated dryers and form one of the constituents of gluten feed. The starch is settled out on long, inclined troughs and dried. Glucose is manufactured by boiling starch paste with mineral acid, neutralizing the acid and filtering and evaporating the liquid.

The sulphurous acid used in steeping the corn is made at the plant by burning sulphur in cast-iron ovens and absorbing the resultant sulphur dioxide in water which is made to trickle down towers up through which the sulphur dioxide is caused to pass by means of forced draft produced by a steam jet located near the exit of each absorption tower. The absorption of the sulphur dioxide is not complete and considerable sulphur dioxide passes off with the steam through each of the three exits.

Strong sulphurous odors were noticed in the following places:

1. At the exits of the sulphur-dioxide absorption towers and in the building where the sulphurous acid is made and stored
2. On two of the floors in the so-called Table House
3. On various floors in the wet starch house where the reels are located.

The sulphurous odors in portions of the plant were so strong as to be particularly objectionable and even produced a stifling sensation, making it difficult to breathe.

On the premises of the plant and at a considerable distance to the leeward a characteristic composite acid and organic or grain odor was noticed. Its intensity seemed to vary inversely with the distance from the plant but the acid odor seemed to diminish more rapidly than the corn odor.

Either hard coal alone or a mixture of 90 per cent. hard coal and 10 per cent. soft coal is used at the power plants and no black smoke was seen issuing from the stacks except for short intervals during the stoking of the boilers.

General Chemical Company

This plant is situated south of the Corn Products Company, opposite 101st Street, New York City. The following chemicals are manufactured: sulphuric acid, acetic acid, trisodium phosphate, disodium phosphate, monosodium phosphate, epsom salts, acetate of lead, acetate of soda, bisulphite of soda and baking powder.

The hydrochlorite acid plant in operation at the time of the last inspection has been dismantled. The making of nitric acid, nitrate of mercury and nitrates of iron, it was stated by the Superintendent had been discontinued at this plant on October 11, 1915. It was stated by the Superintendent that these products would be made at one of the other plants of the company in the future.

Sulphuric acid of which different strengths are made is the principal product at this factory. The acid is made from pyrites by the contact process. This process is practically automatic from the point where the ore is elevated to the storage bins above the burners to the final product and the sulphur dioxide gas generated is under a negative pressure from the burners to the blowers which force it through the transferers, converters and absorbing towers. A moderate sulphur dioxide odor was noticed in this plant. The odor, however, was not sufficiently strong to cause any discomfort in the buildings where the acid is made.

The discharge of uncombined sulphur dioxide from the exits of the absorption towers noted at the time of the previous inspection had been discon-

tinued, and this gas is being conveyed to absorption towers in another building where it is absorbed by means of an alkaline solution. Eighty per cent. of the uncombined sulphur dioxide which was formerly discharged into the atmosphere from the sulphuric acid plant is said to be absorbed in the alkaline absorbing tower. Vapors containing sulphur dioxide were noticed discharging from the exit of the alkaline absorption tower.

Sulphur dioxide was also found to escape from the exit of the absorption tower of the bisulphite of soda plant and could be distinctly detected at points on the premises in line with the exit from this plant.

The acetic acid plant at this factory is located near the water front and although no discharge of gases, fumes, or vapors could be seen escaping from the final exists of this plant, a strong pungent acetic acid odor sufficiently intense to cause an uncomfortable irritating sensation of the nose and throat was found to exist in the building where the acetic acid is made and could be distinctly observed at a considerable distance from the plant.

A peculiar acetic odor was also noticed above the absorption or converting towers of the acetate of lead plant. This odor, however, could not be detected outside of the building in which this chemical was made.

No objectionable odors could be observed in the vicinity of the other portions of these works.

Both soft and hard coal are burned in this plant but no black smoke was observed from the stack except for short intervals during the stoking of the fires.

Barrett Manufacturing Company

This plant is located immediately south of the General Chemical Company opposite 99th Street, New York City. Water gas tar and coal tar products such as paving pitch, roofing pitch, solvent naptha, anhydrous and equeous ammonia, carbolic acid and crude naphthalene are manufactured. The process employed in the manufacture of these products consists largely in the distillation and condensation of the distillates of the tar received from gas and coke works.

The plant was permeated with a strong and somewhat pungent tar or creosote odor which could be detected at a considerable distance from the plant. Characteristic ammonia and naphthalene odors were noticed in the buildings where these products were manufactured but could not be detected more than 100 feet from the place where these chemicals were made.

Attempts have been made to reduce the tar odors given off from certain parts of the plant by passing the vent pipes from the tar storage tanks into barrels for the purpose of condensing the light oil vapors which may be given off. The vapors from the receiving tank in the tar paper plant are passed into a closed iron tank and sprayed with water. Two similar condensing or scrubbing tanks, one of which was already in position at the time of the inspection, are to be installed in connection with the tar cooling tanks. It is expected that the installation of these scrubbers will reduce somewhat the tar or creosote odors given off from the plant.

Both oil and hard coal are used for fuel in the power plant of this establishment and comparatively little smoke is given off from the power plant stack except when the boilers are stoked or the oil burners are first started.

Spencer Kellogg and Sons

This plant is located just south of the Barrett Manufacturing Company opposite 98th Street. Linseed oil and castor oil are made from flaxseed and castor beans respectively, at this plant. Linseed oil is made by grinding heating and pressing the flaxseed; the castor oil by grinding and extracting the oil from the castor beans with the aid of gasoline.

The plant was not in operation at the time of the inspection and except for a slight linseed oil odor which could not be detected outside of the buildings no objectional odors were detected on the premises.

Soft coal is burned at the boiler plant but comparatively little black smoke was discharged from the stack during the investigation.

American Can Company

This company occupies the property formerly occupied by James Pyle & Sons located south of the plant of Spencer Kellogg & Sons opposite 97th Street, New York City. The plant was being fitted up for the manufacture of shrapnel shell. It was stated by the superintendent that the plant would be ready to commence operation about January 1, 1916, and that the company was to purchase its power from the Public Service Electric Company at Edgewater. No objectionable odors of any kind were detected on the premises of this company.

Bulls Ferry Chemical Company

This plant is located south of the American Can Company opposite 96th Street, and is engaged in the manufacture of chemicals and dyes used in the leather, paper and textile industries, such as soft soap, sulphureted oil, textile softeners, color powders, varnish dryers and tanning compounds. The only objectionable odors which could be detected outside of the buildings on the property were from the buildings where the so-called color powder is made. The mixture of the ingredients from which this powder is made is baked in hemispherical cast-iron kettles placed over oil tanks heated by means of furnaces beneath. A peculiar penetrating and objectionable scorched material odor was given off from the buildings where this color powder was being made. This odor could be easily detected at a considerable distance from the plant.

One ton of hard coal is used at the power plant per day and one half ton of coal in the furnaces of the color powder plant. No smoke was noted from the power plant stack but considerable smoke was at times seen escaping from the stacks of the color powder plant.

From the above description of these various plants it is obvious that many of them, owing to the character of the operations carried on or the comparatively unimportant character and effect of any gases, fumes, smoke or odors generated by them, could not be considered as factors or in any way involved in the allegations made by the complainants as to the cause of any nuisance or menace to health in New York County; whereas other of the plants, from the character of the operations carried on and the nature and extent of the gases, fumes, smoke and odors generated, might under certain conditions be factors in the creation of objectionable conditions, such as alleged, in New York County. The plants which were accordingly excluded from any share in the causation of gases, fumes, smoke and odors in New York County, were:

Public Service Electric Company,
Warner Sugar Refining Company,
Sinclair and Valentine Company,
Batterson and Eisle.
Erie Railroad Company Coal Yards,
Coal Storage Yards, New York Edison Company.
Spencer Kellogg & Sons,
American Can Company.

The plants which however, it was thought, from the nature of their operations and the character and extent of the gases, fumes, smoke and odors generated and emitted by them, might under certain conditions be responsible for objectionable conditions in the Riverside Drive section in New York County, are as follows:

Valvoline Oil Company,
Midland Linseed Products Company,
Corn Products Company,
General Chemical Company,
Barrett Manufacturing Company.

It was to these latter plants, therefore, that our inspections and field observations were particularly directed in order to specifically determine if possible whether any noxious gases, fumes, smoke or odors generated or emitted from any of them, were sufficient in intensity or volume to be carried across the Hudson River and be noticeable or objectionable in New York County; or whether through dissemination and dilution they would become so diminished in intensity as not to be detected and not be productive of any offensive or otherwise objectionable conditions in New York County. Our inspectors accordingly made careful observations and studies as previously outlined, of the effect on the New York side of the operation of each of these plants whenever the direction of the wind brought any gases, fumes, smoke or odors across the Hudson River into New York County, and at such times every effort was made not only to detect any noxious gases, smoke, fumes and odors, but to differentiate between them and, so far as possible, to determine what plants shared in the responsibility for their occurrence and in case any such smoke, gases, fumes and odors were so detected and differentiated, to determine the absolute and the relative extent to which they were noticeable and whether they were of such a character or of sufficient intensity to endanger the comfort, repose or health of persons residing in New York County. Complete records of these observations and studies are on file in the Department.

From these intensive observations and studies in the County of New York along the Riverside Drive section, with respect to each of the various plants last referred to, it was found in every case odors characteristic of the gases, fumes or vapors generated in the various processes carried on in the plants, were at times carried over onto New York County and were distinctly noticeable and clearly identified as to their sources. They were noticed, obviously, only when the wind was from a westerly quarter and were most noticeable and distinguishable when the wind was north-west, i. e. at right angle to the direction of the Hudson River, at which times the gases and fumes crossed over the Hudson river onto New York shore by the shortest and most direct paths and in such a manner that the gases and fumes from the different plants were transported separately in parallel courses, permitting each to be individually identified.

On the piers and water front and along Riverside Drive the characteristic odors from all of these plants involved as above referred to, were at various times, when the wind was from a westerly quarter, distinctly noticeable and easily distinguishable. They were, at any one point, only occasionally other than of brief duration but during these brief intervals they were distinctly objectionable and at times were of sufficient intensity to be sufficiently irritating to the throat to produce coughing.

Attention should be called to the fact that on only nine days of the three weeks covered by our investigation was the wind from a westerly direction and on only three of these days was it from such a direction and under such other atmospheric conditions as to carry gases, fumes and odors across the river into New York County, and cause them to be individually distinctly noticeable and objectionable. It is therefore altogether likely that if our observations had been extended over a longer period, other times might have been found when the extent and intensity of these gases and odors would have been more noticeable and the offensive and objectionable conditions resulting therefrom more pronounced.

Finally with respect to the relative share which each of these plants contributed to the objectionable conditions found in New York County, it was found that while the gases and odors emanating from the Corn Products Company, the General Chemical Company, and the Barrett Manufacturing Company predominated, the remaining three of the six plants last referred to,— the Bulls Ferry Chemical Company, the Midland Linseed Products Company, and the Valvoline Oil Company shared almost equally with them. In fact it would be difficult, if not impossible to make a more definite statement in this regard owing to the inherent complex conditions under which the observations were made and to the lack of any measure of standard by which the two essential factors, the offensive and otherwise objectionable nature of

the gases and odors and the volume and intensity of them, could be scientifically or accurately measured.

Prior to and subsequent to the receipt of your order, a large number of individual written complaints were received by the Department and during the investigation some verbal complaints were also received. The number of these indicates the wide extent of the nuisance complained of. The complaints cover a wide range of allegations, some characterizing the conditions as merely annoying or disagreeable while others characterize them in stronger terms as being obnoxious, oppressive, offensive and directly or indirectly affecting health and life. Unfortunately few of them were specific as to the particular time or times when these objectionable conditions were noticed, although a few stated that they were noticeable under certain general conditions of wind direction. From the character and number of the complaints and the results of this investigation, I am of the opinion that some of the complaints are based on conditions which occur at infrequent intervals or at special times. It is however distinctly possible and perhaps probable that at the time of this investigation, as the result of unusual care in the operation of the plants, the conditions were distinctly better than at most other times.

From a careful review of the facts and evidence presented by this investigation, and the statements of complainants, I hereby find and certify:

1. That in the borough of Edgewater, county of Bergen, State of New Jersey, there exist and are being maintained and operated a number of industrial and manufacturing plants engaged in the manuacture of chemicals, foods, oils and other products and in other operations.

2. That from the stacks, buildings and premises of certain of these manufacturing plants, more especially the Corn Products Company, General Chemical Company, Barrett Manufacturing Company, Bulls Ferry Chemical Company, Midland Linseed Products Company and the Valvoline Oil Company, smoke, gases, fumes and vapors are emitted continuously or intermittently which, under certain atmospheric conditions, are carried across the Hudson River and descend and pass upon or over New York County.

3. That the smoke, gases, fumes and vapors are generally of an offensive, disagreeable and otherwise objectionable nature.

4. That when the smoke, gases, fumes and vapors pass over and descend upon New York County, they are clearly evident and distinguishable and to a marked extent offend the senses of sight and smell, cause irritation to the nose and throat, at times cause coughing and are offensive, and thereby affect the comfort and repose of residents of New York County.

5. That since the smoke, gases, fumes and vapors at times affect the nose and throat and cause coughing and are offensive, they do affect at least indirectly if not directly the security of life and health of the residents of New York County, but the extent and measure of this effect it is almost impossible for any one to determine.

I hereby find and certify that the conditions arising from the emission of smoke, gases, fumes and vapors from certain plants located in the borough of Edgewater, county of Bergen, State of New Jersey, constitute a public nuisance which affects the comfort and repose and also indirectly if not directly the security of life and health of a considerable number of persons in the county of New York.

Very respectfully,

HERMANN M. BIGGS,
Commissioner of Health

ALBANY, N. Y., *October* 30, 1915

SPECIAL INVESTIGATIONS

[831]

SANITARY INSPECTION OF SUMMER RESORTS

Since the reorganization of the Department under the amended Public Health Law, the inspection of the sanitary condition of summer resorts has been carried on by the sanitary supervisors who have referred to the Engineering Division for advice and directions in prosecuting this work. This investigation has largely consisted in the reinspection of many of the eleven hundred summer hotels whose sanitary conditions have been examined during the past eight years with a view to determining whether conditions criticised by the Department had been corrected and to arrange for placing these resorts in proper sanitary condition.

INVESTIGATIONS AND ACTIONS UNDER AMENDED PUBLIC HEALTH LAW

Section 76-a of the Public Health Law provides that the State Commissioner of Health, with the concurrence of the Governor and the Attorney-General, may order the discontinuance of sewage discharge in cases where nuisances or menace to health are created. The provision does not apply to waste matter from industrial establishments. During 1915 action was taken by the Department under this section or under sections 76 and 84 of the Public Health Law, by holding hearings in respect to the sewage discharge of some six municipalities. Conferences were also held or investigations conducted in the case of many other municipalities discharging sewage without proper treatment.

Among the more important instances of sewage discharge without adequate treatment in connection with which formal hearings were held as provided by law may be mentioned Hornell, Binghamton and Newburgh.

No formal orders were issued to these three municipalities owing to the fact that the municipal authorities expressed their willingness to proceed within a reasonable time to arrange for proper treatment of sewage.

INVESTIGATION OF SANITARY CONDITION OF STATE INSTITUTIONS

In accordance with section 14 of the Public Health Law, as amended by chapter 559 of the Laws of 1913, the investigation of the sanitary condition of State institutions, commenced last year, has been continued this year.

These investigations comprise in all cases a careful inspection of the grounds, buildings and other features to determine the sanitary conditions with respect to water supply, sewerage, sewage disposal, plumbing, ventilation, garbage disposal, milk supply, etc. Thirty-two institutions were investigated and reported upon and as required by law, the reports transmitted to the institution authorities. The institutions investigated during the year are as follows:

Charitable and reformatory institutions

Albion — Western House of Refuge for Women
Bedford Hills — New York State Reformatory for Women
Iroquois — Thomas Indian School
Newark — State Custodial Asylum for Feeble Minded Women
New York (Randall's Island) — New York House of Refuge
Raybrook — New York State Hospital for the Treatment of Incipient Pulmonary Tuberculosis
Rome — Rome State Custodial Asylum
Sonyea — Craig Colony for Epileptics
Thiells — Letchworth Village

State hospitals for the insane

Binghamton — Binghamton State Hospital
Brooklyn — Long Island State Hospital
Buffalo — Buffalo State Hospital
Central Islip — Central Islip State Hospital
Collins — Gowanda State Hospital

Kings Park — Kings Park State Hospital
Middletown — Middletown State Homeopathic Hospital
New York (Wards Island) — Manhattan State Hospital
Ogdensburg — St. Lawrence State Hospital
Poughkeepsie — Hudson River State Hospital
Rochester — Rochester State Hospital
Utica — Utica State Hospital
Yorktown — Mohansic State Hospital

Prisons and hospitals for insane criminals

Auburn — Auburn State Prison
Beacon — Matteawan State Hospital
Comstock — Great Meadow Prison
Dannemora — Clinton Prison and Dannemora State Hospital
Ossining — Sing Sing Prison
Valatie — State Farm for Women

Other State institutions

Buffalo — State Institution for the Study of Malignant Diseases
Farmingdale — Farmingdale Agricultural School
Fire Island — Fire Island State Park
Morrisville — New York State School of Agriculture

Below will be found the complete reports on the investigations of the above institutions.

CHARITABLE AND REFORMATORY INSTITUTIONS

Western House of Refuge for Women, Albion

HERMANN M. BIGGS, M. D., *State Commissioner of Health:*

I beg to submit the following report on an investigation of the sanitary conditions at the Western House of Refuge for Women at Albion. An inspection was made of this institution by Mr. C. M. Baker, assistant engineer, on August 25, 1914.

A previous investigation of this institution was made in 1911, the report thereon being published in the annual report for that year.

Location and general description

Location.— Village of Albion, county of Orleans.

Capacity.— Two hundred and fifteen.

Present population.— Inmates, 240; employes, 63; total, 303.

Class of inmates.— The institution receives upon commitment, females between the ages of 16 and 30 years, convicted by any court or magistrate of petit larceny, vagrancy, habitual drunkenness, of being a common prostitute, of frequenting disorderly houses or houses of prostitution, or of a misdemeanor, and who is not insane nor mentally or physically incapable of being substantially benefited by the discipline of such institution.

Area of grounds.— Ninety-two and one-half acres.

Number of occupied buildings.— Twelve.

Site of institution.— The institution is located near the western boundary of the village of Albion in the county of Orleans. The station of the New York Central and Hudson River railroad in the village is about one mile from the institution, and a station of the Buffalo, Lockport and Rochester electric railroad is located practically at the gate of the institution. The Erie canal passes just to the north and the New York Central railroad just to the south. A small creek runs through the institution grounds. In the vicinity of the buildings the slopes are such that the drainage is good, but some portions of the farm lands are rather low and the drainage not so satisfactory.

The surrounding country is rolling and the general elevation of the vicinity is approximately 500 feet above sea level. The soil is a clayey loam and the subsoil clay mixed with gravel. In general it appears that the location is well selected for an institution of this character.

Buildings and grounds

General description of buildings.— On the grounds there is a total of 22 buildings, including the administration building; 7 cottages, with capacities of 22 each, and a reception cottage, with a capacity of 60; a hospital, an amusement hall, a cold storage, power house, farm house and other necessary farm buildings. The buildings occupied by the inmates are located in a group about a quadrangle, except Cottage 7, which is just without the quadrangle. The cottages are two stories high, with basements, except the reception cottage, which is three stories and basement. All but the farm buildings are constructed of brick. The buildings appear to be well arranged, both as to location on the grounds and the arrangement of the interior. In some of the cottages the laundries are in the basements, the dining-room and kitchen, also rooms and toilet for some of the employes, are located on the first floor, and on the second floor are rooms and toilet facilities for the inmates. In the other cottages the dining-room and kitchen are in the basements, the arrangements on the other floors being about the same. The reception cottage is divided into 60 cells by brick partitions. The size of the cells is approximately 6 x 10 feet, 7 feet high.

The grounds are pleasantly located and laid out. They are enclosed by a wooden picket fence, which, however, is somewhat in need of repair.

General physical and sanitary condition of buildings and grounds.— The reception cottage, as stated above, is a brick building with brick partitions. It is plastered directly on the brick walls. The inspector was informed by the authorities at the institution that this resulted in considerable dampness in the building, necessitating building a fire to eliminate it, even during the summer, when there is a rainy or damp period of any considerable duration. This is a condition which must, necessarily, be detrimental to the health of the inmates and should, therefore, be eliminated as soon as possible.

The basements of the older cottages, 1 to 4, inclusive, are provided with concrete floors which are somewhat in need of repair. During heavy rains water enters these basements through the walls and floors, resulting in considerable dampness. These conditions should be corrected by repairing the floors and providing the necessary drains or protection to prevent the water entering.

The barn at the institution is of recent construction. It is well equipped and at the time of the inspection was in a satisfactory condition. The piggery was in fair condition when inspected, but it is evident that it is so located, with reference to drainage and the ground, that during a heavy rain water will drain directly into it, thus making it difficult to maintain it in a sanitary condition. This condition should be corrected.

Aside from the criticisms given above, the buildings were found in a very satisfactory condition and are evidently being maintained in good repair.

The institution owns 92.5 acres of land, 20 of which are enclosed. No insanitary conditions were observed about the grounds.

Water supply

The general institutional water supply is derived from the public water supply of the village of Albion, which is furnished to the village by a private company. Drinking water, however, is carried from the well located at the institution farm. The conditions existing regarding the village supply at the time of this recent investigation were the same as when the previous investigation, mentioned above, was made and was then described as follows:

> "It may be said without any qualification that the village supply is quite unsatisfactory and at times entirely inadequate. It is in the hands of a private water company which seems unwilling or unable to take active measures to improve present conditions. When the company was inaugurated the supply was obtained from wells in sand in the northern part of the village; but when this supply was found to be insufficient it was supplemented by pumping water from a neighboring creek, understood and acknowledged to be polluted, into artificial basins in the immediate vicinity of the wells, with the idea that the percolation through the sand beds would both increase the yield of the wells and improve the quality of the creek water thus supplied. It is said that the Erie Canal water is also used for pumping from the bed, although this fact could not be verified. Certain citizens of the village have undertaken to develop a new supply, and to make it possible for the village to free itself from the present necessity of using, on occasion, the water of bad quality furnished by the private company."

The president of the village board of trustees, however, informed the inspector that the village had voted a bond of $165,000 for the purpose of purchasing and improving the water supply, $100,000 to be used for purchasing the present plant and $65,000 for improvements, either by filtration or by providing new wells. However, up to the time of the inspection, due to financial conditions, the village had been unable to place the bonds.

The well from which the drinking water is obtained is located just at the rear of the farm cottage, about 75 feet from the cottage cesspool, 45 feet from a privy used by some of the farm help, 75 to 150 feet from the barns and other farm buildings, and about 175 feet from a cesspool receiving the drainage from a cow barn. The surface drainage is from the well toward the barns and other outbuildings. The well is drilled to a depth of about 75 feet through a soft reddish stone, spongy in character and of the sandstone variety, except for the first 6 or 7 feet. It is cased with a 5-inch pipe.

An iron pump supported on a wooden platform is used to draw the water from the well. The inspector was informed that the well had been cleaned in May, at which time a number of frogs, toads, etc., had been removed. After cleaning, the top of the casing was sealed with concrete and the well was more effectively protected from surface contamination.

Samples of both supplies were taken at the time of the inspection and sent to the Division of Laboratories and Research for analyses. These results, together with those of other previous analyses, are recorded in the table below:

DATE	Free ammonia	Albuminoid ammonia	Nitrites	Nitrates	Oxygen consumed	Chlorine	Total hardness	Alkalinity	Bacteria	B. Coli		
										10 c. c.	1 c. c.	1-10 c. c.
VILLAGE SUPPLY												
February 16, 1910	.008	.012	.002	Trace	1.20	14.75	203.0	162.0	60	—	—	—
June 23, 1910	.018	.032	.001	1.60	1.00	13.25	188.5	178.0	4,500	—	—	—
October 14, 1910	.005	.045	.001	2.00	0.60	14.00	183.5	169.0	20	—	—	—
November 25, 1910	.012	.066	.001	1.50	1.80	15.25	182.0	174.0	750	—	—	—
December 17, 1910	.006	.072	.003	2.88	2.55	12.75	191.4	165.0	950	—	—	—
February 2, 1911	......	......	......	......	......	......	......	......	25	—	—	—
February 2, 1911	......	......	......	......	......	......	......	......	100	—	—	—
February 4, 1911	.006	.019	.001	2.40	1.70	15.75	182.8	131.0	30	—	—	—
April 13, 1911	.008	.034	.001	4.00	1.80	14.75	191.4	157.0	130	—	—	—
June 3, 1911	.026	.170	.001	0.80	6.60	12.25	214.5	191.0	275	+	+	+
July 14, 1911	.004	.010	.001	0.80	2.40	11.75	180.0	154.0	250	+	+	—
September 20, 1911	.002	.161	.001	0.60	3.00	14.50	180.0	159.0	160	+	+	—
November 31, 1911	.004	.192	.001	1.20	4.30	20.75	214.5	153.0	300	+	+	—
December 2, 1911	.018	.162	.002	1.60	4.50	15.00	200.0	163.0	600	+	+	—
December 5, 1911	.032	.152	.001	1.60	3.10	14.50	180.0	163.0	120	+	—	—
January 29, 1912	.024	.098	.004	2.60	3.80	16.00	300.0	109.0	500	+	+	—
March 4, 1912	.012	.102	.003	2.40	3.90	13.50	185.8	155.0	3,400	+	—	—
March 8, 1912	.025	.096	.002	2.50	3.60	12.50	300.0	165.0		+	......	......
March 26, 1912	.026	.184	.004	2.80	5.30	8.25	182.0	111.0	6,900	+	+	—
April 22, 1912	.006	.146	Trace	2.40	5.10	13.50	271.5	151.0	4,900	+	—	—
May 1, 1912	.006	.122	Trace	2.00	4.90	13.25	271.5	161.0	500	+	—	—
May 29, 1912	.010	.188	Trace	2.40	6.70	12.50	171.4	150.0	210	+	+	—
June 27, 1912	.004	.094	.001	1.70	5.00	14.00	191.4	190.0	3,000	+	—	—
September 18, 1912	.004	.116	.001	1.00	4.50	15.00	228.5	189.0	6,100	+	+	—
October 14, 1912	.034	.104	.003	1.00	5.50	14.25	214.5	161.0	5,300	+	+	+
November 21, 1912	.014	.132	Trace	1.20	4.30	15.00	191.4	160.0	4,100	+	+	—
December 2, 1912	.016	.168	.001	1.40	4.70	15.00	257.0	175.0	1,500	+	—	—
January 13, 1913	.016	.089	Trace	2.50	4.30	9.25	162.9	129.0	3,900	+	+	—
March 14, 1913	.032	.130	.001	0.72	5.00	3.75	84.3	71.0	5,930	+	+	—
April 22, 1913	.010	.090	Trace	1.80	3.60	12.00	221.5	170.0	375	—	—	—
May 31, 1913	.022	.100	Trace	1.50	4.40	12.50	188.5	177.0	......	—	—	—
July 25, 1913	.016	.218	Trace	0.70	4.90	1.50	243.0	185.0	11,500	+	+	—
October 3, 1913	.012	.100	.005	1.40	3.20	16.50	148.6	141.0	435	+	+	—
November 12, 1913	.020	.100	.001	1.20	3.60	15.88	228.5	155.0	100	+	—	—
January 23, 1914	.008	.076	.004	0.90	5.30	16.50	300.0	167.0	275	+	—	—
February 11, 1914	.038	.230	.002	4.00	9.00	12.00	393.0	154.0	2,100	+	+	—
June 27, 1914	.010	.116	Trace	1.40	4.60	13.75	221.5	172.0	40,000	+	+	—
August 25, 1914	.004	.012	.002	1.40	3.00	14.63	137.2	135.0	450	+	+	—
FARM WELL SUPPLY												
December 2, 1911	......	......	......	......	......	200.0	......	......	110	—	—	—
March 8, 1912	......	......	......	......	......	580.0	......	......	20	—	—	—
April 17, 1912	.418	.016	.001	0.34	1.50	340.0	671.0	164.0	15	—	—	—
May 1, 1912	1.500	.080	.013	Trace	2.80	625.0	81.4	......	50	—	—	—
May 29, 1912	.062	.008	.001	1.60	0.20	70.0	122.8	......	45	—	—	—
June 27, 1912	......	......	......	......	......	......	......	......	160	—	—	—
October 14, 1912	.066	.016	.001	1.60	1.00	17.0	122.8	......	10,000	—	—	—
December 2, 1912	.048	.042	.001	1.20	0.40	147.0	122.8	......	100	—	—	—
January 13, 1913	.116	.008	.001	1.00	1.50	225.0	97.2	154.0	950	—	—	—
March 14, 1913	.080	.020	.001	1.40	1.10	170.0	91.4	155.0	240	—	—	—
April 22, 1913	.078	.010	.002	1.00	1.00	168.0	105.6	154.0	130	—	—	—
July 23, 1913	.038	.010	.001	1.60	0.20	45.0	140.0	146.0	4,700	—	—	—
May 1, 1913	.036	.005	.002	1.20	0.50	80.0	135.8	150.0		—	—	—
October 3, 1913	.012	.014	.001	1.40	0.70	29.0	191.4	147.0	8,000	+	+	—
November 12, 1913	.220	.010	.007	0.60	3.30	215.0	171.0	166.0	550	+	+	—
January 23, 1914	.420	.012	.037	0.06	5.50	480.0	63.6	134.0	25	—	—	—
February 11, 1914	.820	.140	.075	0.02	6.30	650.0	201.5	186.0	15	—	—	—
June 27, 1914	.006	.010	.003	1.80	0.50	38.0	156.0	151.0	17,500	—	—	—
August 25, 1914	.048	.004	.002	2.24	0.50	29.5	140.0	148.0	50	+	—	—

The analyses emphasize the statement above that "without any qualification the village supply is quite unsatisfactory." The large amount of nitrogenous matter, also the high figures for oxygen consumed and chlorine, indicate pollution. The bacterial content is generally high, with the B. coli type prevailing, indicating the presence of dangerous or active contamination. The hardness is also very high. It is thus evident that the supply is entirely unsatisfactory and, therefore, unless the village proceeds immediately to improve the supply, the institutional authorities should obtain a supply of a safe quality as soon as possible.

The analyses of the farm well supply indicate variable quantities of nitrogenous matter; free ammonia ranging from .006 to 1,500; albuminoid ammonia from 0.004 to 0.140; nitrites from .001 to .075, and nitrates from a trace to 2.24. These results are at times exceedingly high for a deep well water and indicate pollution. This is also indicated by the variable amounts of oxygen consumed, which also is generally high. Chlorine varies from 17 to 650. The latter figure is exceedingly high, which, together with the variation, indicates mineral deposits such as are common in this locality. The hardness is variable and also very high. The bacterial content is variable and at times high with the B. coli type present to some extent during the last two years. It is quite evident from these analyses, and also from the general location of the well, that there is considerable pollution of the well water, and that at times the pollution is of a dangerous character. The well should, therefore, be abandoned and a safe supply substituted.

From the above it may be concluded that both supplies at the institution are unsatisfactory and consequently should either be improved or eliminated and a safe supply substituted. Even if the well supply were satisfactory, there still remains the danger from accidental or intentional use of the other polluted supply from the faucets located in the various buildings of the institution.

The water consumption, as indicated by the monthly meter readings, is about 575,000 gallons daily, or approximately 200 gallons per capita per day.

Plumbing

The plumbing is of the open type, except in the four older cottages and part of the administration building, where the piping is enclosed in the floors and walls of the buildings. In these buildings the piping is about 21 years old, but the plumbing fixtures have been replaced by more modern ones. However, in many cases lead pipe is used for connections with the fixtures and they are not properly provided with vents in all cases. All main drains are provided with house traps and fresh air inlets. In the newer buildings the plumbing is of a modern type and was in satisfactory condition at the time of the inspection. Although, so fas as could be learned, no trouble or inconvenience has been experienced because of the deficiencies in the plumbing system mentioned above, they should be eliminated and all of the plumbing changed to conform with modern practice.

As mentioned above, the drinking water is carried from the farm well in pails. Each girl has a cup in her own room which she is supposed to use, the water being dipped from the pail by a dipper and poured into the cup. This method, if always observed, would, doubtless, be quite satisfactory, but there is always the possibility of the inmates drinking directly from the dipper, or dipping into the pail with their cups. Tanks with faucets would eliminate this objection. However, the substitution of a pure water supply for the present contaminated supply will eliminate the necessity of a pail and allow the drinking water to be drawn directly from the faucets of the main water supply.

Sewerage and sewage disposal

Sanitary sewers of 6 and 8-inch vitrified tile pipe collect and convey the domestic sewage to the disposal plant. A storm sewer collects the storm water and connects with the domestic sewer beyond the disposal plant, whence the sewage is conveyed to a nearby creek. Plans for a sewage system and disposal plant were approved by this Department (see Vol. 19, page 31, annual report, State Department of Health), and the works were constructed in 1898. The disposal plant, however, was not operating satisfactorily at the time of the previous investigation and, in fact, its operation had not been satisfactory for several years past, and recommendations were then made regarding improvements, in consequence of which plans for a new disposal plant were prepared and submitted to this Department and approved in 1912 (see Vol. 33, page 417, annual report, State Department of Health), but the plant has not been constructed. The old disposal plant was, therefore, still in use at the time of this investigation, but operated, practically, only as a strainer. The sewage passed through a screen chamber, thence through coarse stone in one of the compartments of the disposal plant and to the creek. Arrangements are now completed, however, whereby the institution is to connect with the village system and thereby eliminate the necessity of constructing a new disposal plant for the institution. The inspector was informed that this connection was to be made very soon. In view of this fact a detailed description of the sewage disposal plant, as operating at the time of the inspection, will not be given in this report, it being sufficient to state that the method of disposal at that time was unsatisfactory. The village is at present constructing a disposal plant, plans for which were approved by the Department of Health in 1911 (see Vol. 32, page 454, annual report, State Department of Health), and amended plans for which were approved on March 29, 1913.

From the above it is evident that although the method of sewage disposal was unsatisfactory at the time of the inspection, provision is now made to eliminate this unsatisfactory condition.

A cesspool located about 60 feet north of the farm cottage receives the sewage from it and another, just back of the new barn, receives the drainage from the cow barn. They are loosely walled up with stone so that the sewage percolates through the soil from them. A privy at the farm is still used by some of the farm help. No vault is provided, the dejecta being allowed to collect on the ground. There is an opening properly provided with a door in the back for cleaning. This method of allowing fecal matter to collect practically on the surface of the ground must necessarily produce insanitary conditions. It would seem that, since there are toilet facilities in the cottage, similar facilities could readily be provided in the barn, if necessary. In any case, the privy should be abolished.

Garbage disposal

Galvanized cans are provided for receiving the garbage from the kitchen. In some cases covers are not provided for the cans and in others the cover does not fit properly, thus allowing access to flies. Tight-fitting covers should be provided in all cases. The cans are collected two or three times weekly and the contents fed to pigs. Paper and other rubbish are burned.

Heating and ventilation

Heating.— Both the direct and indirect systems of steam heating are used for heating the buildings. The direct system is used in all the older buildings, the others, however, are provided with both the direct and indirect

systems. The indirect system in these cases being used principally in the bathrooms. The heat for all the buildings is furnished from a central power plant. The inspector was informed that some trouble had been experienced in heating the industrial building. The supply main from the boilers to this building is only 2 inches in diameter, and a recent enlargement of the building, with corresponding increased radiation, was made without increasing the size of the main. This would, therefore, appear to be the cause of the trouble in heating this building. In any case, proper provision should be made to furnish sufficient heat.

Ventilation.— Ventilation appears to be satisfactorily provided in all the buildings. There are no dormitories in the institution, each girl being provided with a separate room which is sufficient in size. Cottages 5 and 6 are provided with vent flues which are heated by steam coils. They draw the fresh air from outside the building. The other buildings are provided only with foul air flues. Sufficient windows are also available for ventilation. It was stated above that the institution was caring for more than its rated capacity. This is accomplished by providing beds in the halls for some of the inmates. While the ventilation appears to be satisfactory in these cases, this is a practice which should be eliminated by providing sufficient room elsewhere.

Milk supply

About 70 quarts of milk are furnished daily from the institution herd of 6 cows and the remainder of about 100 quarts daily is bought from outside parties. The institution has had the herd for only about one year and the cattle have not been tested for tuberculosis since they were first bought. The cow barn at the institution, as previously stated in this report, is a new building, is modern and satisfactory in all respects. The milk cans are cleaned at the various buildings, being sterilized by scalding. All cans pass through the store to and from the farm, at which time they are inspected. Samples of the milk are tested monthly by the Agricultural Department and the results indicate milk of a satisfactory physical quality. Although this supply appears to be satisfactory, it would seem that regular tuberculin tests should be made of the herd at sufficiently frequent intervals to assure it being free from tuberculosis.

The milk obtained from outside parties is bought from two local dealers by contract. So far as could be learned each dealer furnished the milk for the institution from his own herd. These dairies were inspected some time ago by the superintendent and steward of the institution at which time, the inspector was informed, they were found in a satisfactory condition. It appears, however, that no regular and systematic inspections are made. No definite information was available as to whether these herds were tubercular free. In fact, so far as could be learned, no tuberculin tests have been made of them. In view of the evident uncertainty as to whether these herds are free from tuberculosis, and also because of the difficulty of controlling the conditions under which the milk is produced and furnished by outside parties, it would seem advisable either for the institutional authorities to furnish a sufficient number of cows to supply all of their own milk or that they obtain a modern pasteurizer and pasteurize all milk obtained from outside the institution.

Conclusions and recommendations

As a result of this investigation I beg to submit the following conclusions and recommendations:

1. That, in view of certain insanitary conditions in some of the buildings at the institution, as described in detail in the body of this report,

(a) The necessary repairs or alterations be made in the reception cottage to eliminate the dampness in the building at all times.

(b) Adequate drains and protection be provided for the basements to eliminate the dampness in them where such conditions exist.

(c) The piggery be properly located or protected, with reference to drainage, so that it can be easily maintained in a sanitary condition at all times.

2. That in view of the unsatisfactory condition of the water supplies at the institution,

(a) Unless steps are taken at once either by the village or the authorities now in control of the present supply to improve its quality, the institutional authorities proceed, without delay, to provide a new and satisfactory supply for the institution.

(b) The well now being used at the farm be abandoned and a satisfactory supply substituted.

3. That in view of the obsolete type of plumbing still in use in some of the buildings, it be replaced by plumbing of a modern type as soon as possible.

4. That in regard to sewerage,

(a) The connection with the village system be made as soon as possible.

(b) The privy at the farm be abolished.

5. That, to assure proper protection against flies, tight-fitting covers be provided for all garbage cans and that they be properly protected in all cases to prevent the propagation of flies.

6. That regarding heating and ventilation,

(a) Adequate facilities be provided for heating the industrial building at all times.

(b) The beds located in the halls of the cottage be removed and suitable room for the inmates occupying these beds be provided elsewhere.

7. That, to assure a satisfactory milk supply,

(a) Regular tuberculin tests be made of the institution herd at sufficiently frequent intervals to assure the absence of tuberculosis from it.

(b) Milk obtained from outside parties be pasteurized by a modern pasteurizer.

Respectfully submitted,

THEODORE HORTON,
Chief Engineer

ALBANY, N. Y., *April* 8, 1915

New York State Reformatory for Women (Bedford Hills)

HERMANN M. BIGGS, M.D., *State Commissioner of Health:*

I beg to submit the following report on an investigation of the sanitary conditions at the New York State Reformatory for Women at Bedford Hills. An inspection was made of this institution on April 23, 1915, by Mr. C. M. Baker, assistant engineer, and this report was based upon information obtained at that time:

A previous investigation of this institution was made in 1911, the report thereon being published on page 964 of the annual report for that year.

Location and general description

Location — At Bedford Hills, town of Bedford, county of Westchester.
Capacity — 419 inmates.
Present population — Inmates 411, employes 96, total 507.
Area of grounds — 195.5 acres, belong to the institution, in addition to which about 16.5 acres are rented.
Number of occupied buildings — 18.
Class of inmates — The institution receives, upon commitment, delinquent females between the ages of 16 and 30 years, who are not insane nor mentally or physically incapable of being substantially benefited by the discipline of such an institution. The average age of those at the institution is about 21 years.
Site of institution — The institution is situated about one mile east of Bedford Hills, and is reached from New York city over the Harlem division of the N. Y. C. R. R. to Bedford Hills, thence by conveyance to the institution. A small stream, known as Broad brook, and which is tributary to the Croton water supply, flows through the grounds belonging to the institution. The buildings are all located on elevated ground, which offers satisfactory drainage.

Buildings

General description of buildings — The buildings consist of an administration building, eight cottages which are completed and now in use, and seven which are being constructed and are nearly ready for occupancy, also Rebecca Hall, or the old Reception Building; an old hospital and a new one which is nearing completion; two farm cottages, power house, barns and other accessory buildings. The old reception building mentioned above, however, is now being used as a disciplinary, and the inmates are received at a new building known as Elizabeth Fry Hall, the use of which is donated to the State by the Bureau of Social Hygiene.

The buildings are arranged in several groups about the grounds, the different groups being some distance apart. The main group includes the administration building, eleven cottages, power house, etc. Four new cottages, which are being constructed some distance from this group, are to be known as the Foreign Cottages. Elizabeth Fry Hall is also located some distance from the main group, and likewise the two farm cottages.

General physical and sanitary condition of buildings — The four cottages and Rebecca Hall, which constitute the old original group of buildings, were found in a very unsatisfactory condition. The plaster was loose and falling in some places in the halls and baths of the cottages. The kitchen floors were badly worn and in need of repair in all of them, and the cupboards, shelves, etc., in the pantries are loosely constructed of boards, thus offering an excellent habitat for roaches, water bugs, etc., many of which were seen crawling about on the shelves and in the cupboards.

Rebecca Hall, a part of which is equipped with cells, is an old structure. The cells are 8 feet 8 inches by 5 feet and 9 feet high, with a 5-foot corridor in front. The corridor is provided with a concrete floor, which was in a very unsatisfactory condition, there being holes in it three or four inches deep, and, in fact, the whole floor appeared to be disintegrating. The cell floors, consisting of wood laid over the concrete, were decayed in places and much in need of repair, and similar conditions also existed in the toilet sections of this building, thus making it very difficult, if not impossible, to maintain satisfactory conditions. A part of the building is equipped with double rooms, which really consist of two cells converted into one room by eliminating the partition between them. The general condition of this part of the building was more satisfactory than that in which the cells are located, except that the condition in the toilet sections was about the same. In fact, it is apparent that this whole building is very much in need of a thorough overhauling, that it should be remodeled in many respects, and that extensive repairs are needed to put it in a satisfactory condition.

The rest of the cottages are of newer construction, and their condition was in general satisfactory, although it was noticed that in Griffin and Morris cottages the kitchen floors were somewhat in need of repair. In some of the cottages the kitchens and laundries are provided with tile floors.

Turner cottage, which consists of a farm house, rented by the institution, appears to be somewhat overcrowded. The recreation room is used also as a school room, and to some extent as a dormitory, there being two beds in it at the time of the inspection. The kitchen floor in this building was also in need of repair.

The new cottages being constructed are to be modern in all respects, and will afford excellent quarters and facilities for the inmates. Elizabeth Fry Hall is a modern structure and is excellently equipped. The new cottages will afford accommodations for about 200 people, thus increasing the capacity of the institution to about 600.

In view of the unsatisfactory condition in some of the old cottages and buildings as indicated above, it is evident that extensive repairs are needed upon them, and it would seem advisable to make these repairs and put these buildings in a satisfactory condition before the new cottages nearing completion are occupied by additional inmates, that is, before the ultimate capacity, namely 600, is reached, as it would seem that in this way the repairs in the old buildings could be made with less inconvenience.

The basements under the buildings were found to be in a generally satisfactory condition, although it was stated that some trouble had been experienced from dampness in the spring, due to seepage through the walls in the basements under Lowell and Sanborn cottages. This difficulty should be corrected by providing adequate drains and protection against seepage into the basements.

Water supply

The present water supply is derived from a dug well located near the brook which flows through the property of the institution. From the well the water is pumped to a standpipe of about 80,000 gallons capacity. The lining of the well is constructed of brick, some of the brick being omitted near the bottom to facilitate infiltration of the water. Surrounding this lining is a ring of charcoal, which is intended presumably to offer a filtering medium for the water entering the well. There is a pipe connection directly to the well from the brook which, however, is provided with a valve and is supposed to be used only in case of fire, when the normal well supply is insufficient. Although it was stated that this connection had never been used, it would seem that, due to the possibility of leakage through the valve or even the use of this intake in case of fire, there exists a possibility that the institutional water supply may become contaminated, and it is apparent, therefore, that this pipe should be disconnected and that additional storage or supply, if necessary, should be developed or provided for by some other method. The close proximity of the well to the brook and the gravelly character of the soil also offers a source of pollution, since it is doubtful whether the purifying effect of the soil will be sufficient to render the brook water satisfactory in quality by the time it reaches the well.

The use of the present well near Broad brook, as a source of water supply for the institution, has been heretofore condemned by this Department as a result of previous investigations. The soil is sand and gravel, and from the condition of pollution known to exist on the watershed, from the conditions with respect to probable infiltration of brook water into the well, and from the fact that B. coli are occasionally found in dilutions as small as 1 c. c., the present well cannot be considered a safe source of water supply.

Due to the inadequacy of the present supply, plans were submitted and approved on November 24, 1914, for developing an additional supply. The approval of these plans, however, did not consider the quality of the present supply. The plans provide for the construction of a new well 30 feet in diameter and 30 feet deep, located about 10 feet to the west of the existing well, 20 feet east of the power house, and about 60 feet distant from the bank of the brook. The well is to be constructed of reinforced concrete and

provided with a cover of the same material. The bottom of the well will be unlined, and infiltration through the sides will be provided for by weep holes, consisting of 3-inch tile pipes through the lower part of the side walls. The suction line to each of the wells is controlled by a valve, so that water may be drawn from either or both. These plans also provide for the removal of the cesspool receiving the sewage, from the power house to a more distant point. At the time of the inspection, the new well was being constructed and was down to a depth of about eight feet. The supply at that time, however, was being derived entirely from the old well as formerly. Samples of the water were taken and sent to the Division of Laboratories and Research for analysis, the results of which, together with those of other previous analyses are recorded in the following table:

DATE	Nitrogen as—				Oxygen consumed	Chlorine	Total hardness	Alkalinity	Bacteria	B. Coli		
	Free ammonia	Albuminoid ammonia	Nitrites	Nitrates						10 c. c.	1 c. c.	1-10 c. c.
February 6, 1911	.024	.040	.002	0.50	1.30	4.50	60.0	53.0	1,400	+	—	—
December 6, 1911	.012	.024	.002	0.40	0.80	4.87	64.3	54.0	3,000	+	+	—
February 24, 1912	.016	.002	.001	0.44	2.30	5.00	58.6	50.0	18,500	—	—	—
March 27, 1912	.008	.028	Trace	0.33	0.10	6.00	70.0	53.0	100	—	—	—
April 23, 1912	.008	.030	.001	0.04	0.30	5.50	60.0	55.0	40	—	—	—
June 3, 1912	.008	.014	.001	0.40	0.20	7.00	68.6	59.0	2,400	—	—	—
July 3, 1912	.002	.002	.001	0.48	0.10	6.25	70.0	64.0	5,000	—	—	—
August 3, 1912	.002	.002	Trace	0.48	0.10	6.00	71.4	63.0	7,500	—	—	—
October 17, 1912	.004	.014	Trace	0.80	1.00	5.75	77.1	69.0	600	—	—	—
November 27, 1912	.008	.040	Trace	0.50	0.50	7.50	74.3	63.0	3,600	—	—	—
February 5, 1913	.010	.012	Trace	0.48	0.50	7.00	74.3	61.0	......	—	—	—
March 17, 1913	.010	.014	Trace	0.36	0.50	6.00	72.9	61.0	......	—	—	—
April 24, 1913	.010	.020	.001	0.50	0.50	7.00	77.1	62.0	800	—	—	—
May 30, 1913	.012	.020	Trace	0.32	0.60	6.25	71.4	65.0	......	—	—	—
July 28, 1913	.012	.028	.001	0.36	0.20	6.00	84.3	67.0	100	—	—	—
October 9, 1913	.004	.022	.001	0.22	0.50	9.87	78.6	66.0	......	—	—	—
December 9, 1913	.006	.008	.002	0.40	0.80	6.63	68.6	65.0	850	—	—	—
December 24, 1913	.016	.016	.003	0.30	1.40	7.00	74.3	62.0	60	—	—	—
February 3, 1914	.004	.002	.001	0.40	0.80	6.63	64.3	61.0	20	—	—	—
February 28, 1914	.014	.014	.001	0.36	1.20	5.75	65.7	69.0	1,300	—	—	—
April 21, 1914	.014	.014	.001	0.32	0.60	6.50	65.7	61.0	270	—	—	—
August 27, 1914	......	......	......	......	......	......	......	......	310	+	—	—
April 23, 1915	.003	.004	.003	0.40	1.00	6.50	65.7	61.0	45	+	—	—

The results of these analyses indicate a water generally free from contamination. The nitrogenous matter is, in general, comparatively low. The chlorine is somewhat above the normal, which is probably due to the population on the watershed, and the bacterial content, as indicated by the analyses, is variable, being at times very high. The B. coli type are not generally present, although occasionally they have been found in quantities as small as 1 c. c.

In view of the above, it would seem that, with the completion of the new well, a satisfactory supply should be provided. The direct connection which now exists between this supply should be used only in case of emergency, the supply from the new well being relied upon in general.

Plumbing

Some of the plumbing in the old buildings, which were criticised above, was found very unsatisfactory, but in the newer buildings it is apparent that modern practice has been followed, and that the condition and type of plumbing is satisfactory. In the four old cottages the plumbing is not modern. Lead pipe connections are used in many cases and in some instances leaks

were noticed in these connections. The plumbing in Rebecca Hall is of a very obsolete type and was in a very bad state of repair. Lead pipe connections, which were broken and leaking, were noticed in many cases. In one case the vent pipe was entirely disconnected from the trap under one of the lavatory bowls. Pails had been set under the fixtures to receive the drippings in some cases where leaks existed, while in others no such provisions were made. It was stated that the institution now employs a regular plumber, who is engaged in improving these unsatisfactory conditions. It is apparent, however, that, due to the very unsatisfactory and insanitary conditions, additional help should be procured and the insanitary plumbing repaired without delay. The work of renewing the plumbing, however, might be efficiently carried on in connection with the general repairing of the buildings mentioned above, and it is possible that the use of these fixtures and, in fact, the buildings themselves, could be practically dispensed with for a sufficient period of time to make the repairs, when the new cottages are ready to be occupied.

Sewers and sewage disposal

A system of sanitary sewers collects the domestic sewage from the buildings of the main group and conveys it to a disposal plant. A new system, however, is being developed in connection with a new disposal plant, which will take the sewage from this main group of buildings, and also from all of the new buildings now under construction.

The present disposal plant was made the subject of a previous investigation, the report thereon being issued under date of May 20, 1914. This present plant consists of a small screen and grit chamber, septic tank and four intermittent sand filter beds. About the 1st of January, 1914, a temporary hypochlorite plant for the disinfection of the final effluent was installed, and about 15 pounds of hypochlorite of lime added each day. The report on the investigation of the plant mentioned above described the condition then existing as follows:

"At the time of this investigation only one of the four sand filters was in operation while the other three were drying preparatory to cleaning. It was quite evident that the one filter was being greatly overtaxed, as one discharge of the siphon tank did not have opportunity to filter through the bed before the next dose was applied. This overdose caused the sewage to stand upon the surface of this bed constantly, with the result that there was no intermittent action of the bed, without which oxidation of the sewage cannot take place to any appreciable extent. With the estimated flow of sewage of 50,000 gallons daily, the rate of filtration upon this bed was approximately 1,000,000 gallons per acre per day, which is at least ten times as large as is considered desirable for this type of filter."

A number of samples were also taken at this time and sent to the Division of Laboratories and Research for analyses, the results of which, together with the general conditions, indicated that the plant was operating inefficiently, and also that the hypochlorite plant as then constructed and operated did not effectually sterilize the effluent.

The small brook into which the effluent discharges flows into Broad brook, which is tributary to the Croton water supply, and the effluent from the sewage disposal at the institution should, therefore, be well purified in order that the supply of water for New York city be properly safeguarded. As a result of this previous investigation the following recommendations were made:

> "1 That pending the construction of a sufficiently large disposal plant the present filter beds be cleaned at once and put into operation at the earliest possible moment."
>
> "2 That the present disinfecting plant be thoroughly overhauled and put into proper shape to deliver the proper amount of hypochlorite with the effluent. In case this disinfecting plant has not sufficient capacity it should be enlarged until it is capable of satisfactorily treating the effluent."

"This is a case where sterilization of the sewage effluent should be obtained and the chlorination plant requires exceptionally careful design and operation."

At the time of this present investigation of the institution the chlorination plant had been remodeled to some extent, and then consisted of a large wooden tank into which the hypochlorite was mixed by hand, and from which the discharge was regulated by a hand valve. It was stated that 40 pounds of hypochlorite were being used per day, the powder being mixed in the tank and the tank then filled with water, and the flow regulated so that the tank would empty in 24 hours. The filter beds had been cleaned and put into operation, although the dosing apparatus for one of the beds was out of order so that this bed could not be shut off, there being a continuous flow of sewage upon it. The engineer at the institution stated, however, that a plug was being made for the inlet to this bed so that it could thus be shut off.

It is apparent from the above and, in fact, it is generally recognized, that the present method of sewage disposal is unsatisfactory and, in view of this fact, the matter of providing adequate disposal has been taken up. Plans have been approved by this Department and, in fact, the construction of a new disposal plant was in progress at the time of the inspection. The original plans as approved provided for chemical precipitation and an electrolytic treatment plant. This method, however, was approved only upon condition that slow sand filters also be provided and maintained ready for use at any time in case the electrolytic treatment did not operate satisfactorily. Modification of these plans is, however, now being considered by the State Architect and revised plans will doubtless soon be submitted for approval.

The sewage from Elizabeth Fry Hall discharges into a separate disposal plant, consisting of Imhoff tanks with subsurface irrigation. This plant appeared to be operating satisfactorily at the time of the inspection, and it was apparent that no trouble had been experienced with it.

The milk house located near the barn, where the segregated herd is kept, drains into a cesspool located about 30 feet from the creek. This cesspool is on low ground, where the ground water is very near the surface and, therefore, the contents are almost continually overflowing and discharging directly into the creek. Although the sewage here consists only of drainage from the milk house, consisting mostly of washwater used in washing the utensils, it would seem that a more satisfactory method of disposal should be provided.

Near the new disposal plant under construction was an open ditch which, at the time of the inspection, received the sewage from the farm cottage located nearby, and also from an open workmen's privy located over the end of it. Although this is apparently only a temporary arrangement, the conditions at the time of the inspection were very unsatisfactory, there being a very disagreeable odor and, as the distance from the privy to the milk house is only about 250 feet, it would seem possible that contamination of the milk supply might result through fly transmission, especially later in the season. The farm cottage is eventually to be connected with the general sewer system.

Garbage disposal

The kitchen garbage is collected in covered galvanized cans and fed to pigs. Ashes and similar refuse is disposed of at a dump in a remote portion of the ground, where filling in is required. Much of the refuse from the institution is burned at an improvised incinerator located near the present sewage disposal plant. This device consists of an iron fence about 8 feet square, located about 20 feet from the brook, into which the effluent from the sewage disposal plant discharges. Although it was stated that it is the practice to burn the refuse each day, at the time of the inspection there was considerable material in the enclosure, consisting of old clothes and some garbage, which had not been burned. The drainage is from the incinerator to the brook, and it would seem that, since this brook finds its way into the Croton water supply, the incinerator should be removed further from the stream in order to offer satisfactory protection against contaminating the water of the brook.

Heating and ventilation

Heating.— Steam heat is used for heating all the buildings except four of the new buildings, which are provided with hot water heat. The steam for heating is all furnished from the central plant and is said to be sufficient except in Rebecca Hall, where there is evidently insufficient radiation. In connection with the improvement or enlargement of the present plant, which was in progress at the time of the inspection, adequate provision is being made for heating the new buildings. Both the direct and indirect systems of radiation are used.

Ventilation — Where the indirect system of radiation is used, the fresh air is taken from outside the building, but in general the windows are depended upon for ventilation. It seems that, if the windows are all properly regulated, satisfactory ventilation should be provided for the various buildings. It was difficult, however, to judge actual conditions at the time of the inspection, because it was then mild weather and the majority of the windows were open, which would not be the case during winter weather. There was little, if any, overcrowding at the institution at the time of the inspection, and it is apparent that, with the completion of the new buildings now under construction, adequate room should be provided at this institution.

Milk supply

All but about 80 gallons daily of the milk supply is furnished from the institution herd. Two herds are maintained at the institution: one a segregated herd and the other a young herd which has been raised from the segregated herd and which has been tested and found to be free from tuberculosis. These herds are kept in barns located some distance apart. They are cared for by different people and there is apparently little, if any, opportunity for the tubercular free herd becoming infected from the segregated herd. The milk from the segregated herd is pasteurized in a modern pasteurizer being raised to a temperature of 150 degrees and held at that temperature 30 minutes. The cow barns, while not entirely modern in type, were very clean at the time of the inspection and were apparently well cared for. A milk house is located near the cow barn for the segregated herd and is well equipped with a modern pasteurizer, hot and cold water and adequate facilities for cleaning and sterilizing the milk pails and utensils. No milk house is provided at the barn for the tubercular free herd but this barn is maintained in a very clean condition and the milk is taken directly to the kitchen. While it is apparent from the above that the milk supply being furnished from the institution herd is being well looked after and cared for, it is evident that more adequate facilities are needed as the present barns are not modern and are not conducive to a satisfactory protection of the milk supply.

The milk obtained from outside the institution is bought from a local dealer who sells in the village and is under the regulation of the local health authorities. No inspection of his dairy has been made by the authorities at the institution. While it is possible that this supply is satisfactorily looked after and controlled by the local authorities, it would seem that regular inspection should be made by the institutional authorities to assure the maintenance of satisfactory conditions and the furnishing of a satisfactory supply of milk. The information obtained as to whether this herd had been tested for tuberculosis was indefinite.

As a result of this investigation, it is evident that a number of unsatisfactory and insanitary conditions exist at the New York State Reformatory for Women at Bedford Hills and I, therefore, beg to submit the following recommendations regarding sanitary improvements, to be acted upon by the institutional authorities.

Recommendations

1. That, in view of the unsatisfactory condition of a number of the buildings, as pointed out in detail in the body of the report,

(a) The plaster of the walls and ceilings and the floors of all cottages be repaired where such repairs are needed, and also all pantries be properly equipped with satisfactory shelving and cupboards and effective steps taken to eliminate roaches, water bugs, etc., from the pantries

(b) Rebecca Hall be thoroughly overhauled, repaired and remodeled so as to render it sanitary in all respects and as modern as practicable

(c) Where dampness exists in any of the basements as in Lowell and Sanborn cottages, adequate drains and protection be provided to eliminate it

2. That, in regard to the water supply, the intake from the old well to the creek be disconnected and this supply be used only in case of emergency.

3. That, in view of the obsolete plumbing and its unsatisfactory condition in some of the older buildings as pointed out in detail above, this plumbing be thoroughly overhauled and remodeled to conform with modern practice.

4. That, although the completion of the new sewage disposal plant will provide a satisfactory method of disposing of the sewage from the institution certain other matters should now be considered as follows:

(a) The new plant should be completed as soon as possible and in the meantime the present plant should be very carefully operated.

(b) The cesspool receiving the drainage from the milk house should be abandoned and this sewage either discharged into the general system or otherwise satisfactorily dsposed of.

(c) The ditch located near the new sewage disposal plant and receiving the sewage from the nearby farm cottages and a workmen's privy, be abandoned and filled in; and that temporary cesspools be provided to receive the sewage from the farm house, and a privy with a tight vault and located a greater distance from the milk house be provided for the workmen.

5. That with respect to garbage disposal, the incinerator be removed to a greater distance from the stream and so protected that the drainage will not pass directly toward the stream.

6. That, in view of the apparent inadequate heating facilities for Rebecca Hall, due doubtless to insufficient radiation, this condition be corrected.

7. That in regard to the milk supply:

(a) A modern dairy barn and equipment be provided so that the milk may be conveniently produced under sanitary conditions in all respects.

(b) Providing it is necessary to obtain milk from outside parties the institutional authorities regularly inspect the dairies of these parties and use proper precautions to assure that the milk is at all times of a satisfactory quality.

Respectfully submitted,

THEODORE HORTON,
Chief Engineer

ALBANY, N. Y., *May* 17, 1915

Thomas Indian School (Iroquois)

HERMANN M. BIGGS, M.D., *State Commissioner of Health:*

I beg to submit the following report on an investigation of the sanitary conditions of the Thomas Indian School at Iroquois.

Ths institution was visited and inspected on March 29, 1914, by Mr. C. M. Baker, assistant engineer. A previous investigation, however, was made in 1911, the report thereon being published in Vol. 32, page 996 of the annual report of this Department.

Location and general description

Location—Iroquois, on Cattaraugus Indian reservation in the county of Erie.

Capacity.— One hundred and eighty-one inmates.

Present Population—Inmates: male, 88; female, 103; total, 191; employes, 45; total population, 236.

Area of Grounds.— One hundred acres.

Number of Occupied Buildings.—Ten.

Class of Inmates—The institution receives destitute orphan Indian children of both sexes and varying from the primary age to about 18 years. The object of the institution is to furnish them an education and training along industrial lines

Site of Institution—The institution is located in the valley of Cattaraugus Creek, about three and one-half miles from Lawton station and about six and one-half miles from Collins which are on the Buffalo and Jamestown branch of the Erie railroad. The site affords satisfactory drainage and it is apparent that the location is well selected for an institution of this character.

Buildings

General description of buildings.— The main group of buildings including the administration building, kitchen and dining room building, 4 cottages and a school are connected by underground conduits or pipe galleries the top of which is used as a walk in going to and from the various buildings. The dining room and kitchen building is located just to the rear of the administration building and it, with two cottages and the school located to the west, and two cottages and a proposed industrial building to the east, form a crescent about the administration building. To the rear of this group are the hospital, employes cottage, laundry, shop, barn and other farm buildings, there being in all some 25 buildings on the institution grounds.

General physical and sanitary condition of buildings.— The principal buildings are one and two stories high and are constructed of brick, but the other less important ones are wooden structures. The carpenter shop, the cold storage building and the conduits between the main buildings, all of which are constructed of wood, were found in an unsatisfactory condition. The carpenter shop is old and in a very unsatisfactory state of repair, in fact the condition of the building is such that it would seem impracticable to attempt to repair it. The floor and floor joists are decayed and weak, also the ceiling, over which is located a storeroom and which carries the shafting in connection with the machinery, is weak and has had to be shored up in a number of cases. The cold storage building was not originally intended for this purpose and is very poorly adapted to the use being made of it. Only one storeroom is provided, making it necessary to store all commodities including butter, eggs, meat, etc., in one compartment. The building is old and its condition is such that it is very difficult to keep it in a sanitary and satisfactory condition. The conduits connecting the main group of buildings were originally covered with a temporary wooden structure which is still in use. The top of this conduit as mentioned above is used as a walk in going to and from the various buildings. The timbers of which it is constructed are badly decayed; also the boards forming the floor are badly decayed and worn, in many places. The railings at the side of the walk are in very bad condition. In view of the fact that all the children of the institution pass over these walks several times daily there is great danger of accidents, which might result seriously because of the above conditions.

The authorities of the institution have previously asked for appropriations to build a new industrial building which would eliminate the necessity of using the present carpenter shop and also for a new cold storage to provide adequate facilities in this respect. Similar requests have also been made for repairing the conduits which were criticised above. With these improvements carried out, the unsatisfactory conditions which have just been described will doubtless be eliminated. However since it is apparent that means are not now available for this work the institutional authorities should endeavor to obtain them as soon as possible, and, in the meantime

exercise great care and provide such temporary repairs as are necessary to prevent accidents.

The employes' building was undergoing much needed repairs at the time of the inspection and doubtless will be in a satisfactory condition when this work is completed.

Water supply

The water supply comes from three sources. The water for domestic purposes is supplied from a spring located about 1½ miles southeast of the institution and from a flowing artesian well drilled to a depth of about 220 feet located on the institution grounds. The third supply is for fire protection and is derived from a pond located near the institution and supplied by surface drainage.

The water from the well flows into a sump from which it is pumped into an elevated tank, the well and pumps being shut off at night and the spring supply admitted to the mains. The pump has two 4-inch cylinders with a 10-inch stroke. At the time of the inspection it was operating at a rate of 50 strokes per minute but it was apparently drawing considerable air thus indicating that the supply from the well was insufficient for the rate of pumping. The engineers stated that 30 strokes per minute was about the maximum rate that the well would supply and furthermore, that at times this was barely sufficient to meet the demands. On this basis of 30 strokes per minute and allowing an efficiency of 90 per cent. for the pump the amount of water that the well will supply is 42,300 gallons per day. This figure would represent the maximum consumption and would probably correspond to the average consumption of about 25,000 gallons or approximately 100 gallons per capita per day. While it is possible that at times the capacity of the artesian well is hardly sufficient to meet the maximum demand for water it would seem that with proper storage and also with the spring as a supplementary supply sufficient water should be available for domestic use.

The present supply for fire protection is known to be unsatisfactory for domestic purposes and the fire mains are entirely separate from the domestic system. So far as could be determined by the inspector there are no faucets on this supply and the only connection is through the pumps, it being necessary to pump the water in case of fire through the same pumps that are used for supplying the water for domestic use. However, improvements are being made in the fire lines by providing new and larger mains and more hydrants and it is also planned to install a special pump for fire protection which would eliminate the necessity of using the present pumps for that purpose. With these improvements the facilities will doubtless be quite satisfactory but it seems advisable to emphasize the fact that in no case should faucets be provided from the fire supply nor should there be any connections between it and the domestic supply. It is only with such precautions that two supplies, one of which is known to be unsatisfactory in quality, can be safely used.

Samples of water were taken from the domestic supplies and sent to the Division of Laboratories and Research for analysis the results of which, together with those of previous analyses are reported in the following table:

DATE	Nitrogen as — Free ammonia	Albuminoid ammonia	Nitrites	Nitrates	Oxygen consumed	Chlorine	Total hardness	Alkalinity	Bacteria	B. Coli 10 c. c.	1 c. c.	1-10 c. c.
WELL SUPPLY												
December 22, 1911	.210	.034	Trace	0.04	0.20	16.37	214.5	216.0	1,100	+	—	—
January 17, 1913	.176	.034	.001	0.02	0.50	16.75	122.8	194.0	3.400	—	—	—
March 17, 1913	.184	.026	Trace	0.02	0.60	16.25	117.2	197.0	2,800	—	—	—
April 24, 1913	.180	.018	Trace	0.02	0.50	16.12	123.5	188.0	600	—	—	—
May 27, 1913	.144	.028	Trace	0.02	0.30	17.00	110.5	198.0	......	—	—	—
July 26, 1913	.186	.028	Trace	0.02	0.60	16.75	120.0	......	......	—	—	—
October 6, 1913	.160	.036	Trace	0.02	0.90	16.87	114.2	197.0	10	—	—	—
November 15, 1913	......	......	......	......	......	......	......	......	20	—	—	—
December 10, 1913	.216	.010	.002	0.02	0.80	17.00	231.4	200.0	55	—	—	—
January 13, 1914	.252	.018	.002	0.02	0.30	13.00	117.2	198.0	50	—	—	—
April 9, 1914	.234	.020	.001	0.02	0.60	16.25	125.8	201.0	20	+	—	—
April 1, 1915	.184	.022	.001	0.06	1.80	17.00	130.0	203.0	5	—	—	—
SPRING SUPPLY												
December 22, 1911	.024	.028	Trace	0.20	0.20	1.00	188.5	188.0	60	—	—	—
January 17, 1913	.010	.012	.001	0.14	0.20	0.87	177.2	176.0	800	—	—	—
March 17, 1913	.008	.030	Trace	0.16	0.50	1.25	160.0	160.0	30	—	—	—
April 24, 1913	.008	.002	.001	0.08	0.30	0.75	174.2	165.0	200	—	—	—
July 26, 1913	.004	.008	Trace	0.06	0.40	1.50	221.5	182.0	......	+	—	—
October 6, 1913	.002	.006	.001	0.10	0.90	1.25	195.0	187.0	80	—	—	—
November 15, 1913	.018	.020	.001	0.14	0.50	3.25	188.5	185.0	60	—	—	—
December 10, 1913	.010	.006	.002	0.14	0.50	1.50	188.5	188.0	40	—	—	—
January 13, 1914	.028	.016	.003	0.08	0.60	1.25	177.2	173.0	55	—	—	—
April 9, 1914	.014	.020	.001	0.14	0.50	1.00	174.2	175.0	5	—	—	—
April 1, 1915	.004	.004	.002	0.20	0.40	1.00	195.0	183.0	5	—	—	—
SAMPLES FROM TAPS ABOUT THE INSTITUTION												
April 1, 1915	......	......	......	......	......	......	......	......	5	—	—	—
April 1, 1915	......	......	......	......	......	......	......	......	10	—	—	—

The results of the analyses indicate waters satisfactory in quality ,from both the well and the spring supplies as is shown by the small amount of organic matter and the fact that organisms of the B. coli type are rarely present. The bacterial content is low except in a few cases where the high results are probably due to multiplication in the sample in transit from the institution to the laboratory as the time thus consumed is usually from 2 to 3 days. Both of the waters are very hard although in each case the hardness is to a large extent temporary hardness. The water from the spring is somewhat higher in permanent hardness and is therefore probably not so satisfactory for boiler use and for hot water pipes as the well water. The inspector was informed that considerable trouble has been experienced with the hot water plumbing because of deposits being formed in the pipes due to the hardness of the water and therefore it may be practical for the institution to consider the installation of a water softening plant to eliminate this difficulty.

Plumbing

The plumbing is principally of the open type although in some cases the piping is enclosed in the walls and floors of the buildings. The system appears to be properly provided with traps and vents and its general condition was satisfactory at the time of the inspection. The facilities were apparently sufficient in number and properly placed and the inspection indicated that they were in a satisfactory condition.

Sewerage and sewage disposal

A combined system of sewers, collecting both the domestic sewage and the storm water from the roofs, discharges, without treatment, into Cattaraugus creek which flows northwest into Lake Erie about 25 miles southwest of the city of Buffalo. The size of the pipes, grades, etc., appears to be satisfactory, but the pipe at the outlet had been washed out and broken by the high water during the previous spring, so that, at the time of the inspection, the sewage was being discharged upon the bank of the stream instead of under the surface of the water as formerly. The inspector was informed that no means were available for repairing this pipe.

The method of discharging the sewage without treatment into Cattaraugus creek was criticised in the preceding report on an investigation at the institution as follows:

"There are no villages on the creek and in all probability the present method of discharge does not constitute a public nuisance though possibly it may injure riparian owners in the immediate vicinity. Since however any pollution of Cattaraugus creek enters and is carried out into Lake Erie only 25 miles west of the Buffalo city intake, a distance over which any infection present might readily be carried under unfavorable conditions of surface currents induced by winds, it is evident that protection should be provided against this danger through sewage purification."

In view of the above it would seem advisable that the institutional authorities provide some method of treatment of the sewage the plans for which should be submitted to this Department for approval.

Garbage disposal

The kitchen garbage is collected after each meal in pails and carried to the piggery where it is fed to the pigs, thus the garbage is retained about the building only a short time. The refuse is either disposed of at a dump in a remote portion of the grounds or is burned. The method of handling and disposing of the garbage appeared to be satisfactory.

Heating and ventilation

Heating — Both the direct and indirect systems of radiation are used in connection with the heating. In the girls' buildings the dormitories are provided with the indirect system while the front of the building is equipped with the direct. The heat is supplied by steam which is generated at a central plant. It was apparent from the investigation that the facilities for heating the buildings were adequate and that in general sufficient is provided.

Ventilation.— The ventilation is done almost entirely from the windows although in some cases ceiling ventilators are provided. The inspector was informed that it is the aim of the institutional authorities to allow 600 cubic feet of air space per bed in the dormitories but it is apparent that this plan is not entirely carried out, possibly due, however, to the fact that the institution is called upon to care for more children than its capacity should permit. In the dormitories of Jenison & Blaisdell cottages, in which there were 22 beds each at the time of the inspection, the cubic space per bed is about 430 cubic feet and in Howland and Lincoln cottages, in which there were 24 beds each, the corresponding figure is 540 cubic feet. In the former cottage however some of the windows were out and cloth provided instead. In fact it is apparent that all of the dormitories are well aired, the windows being left open the greater portion of the day so that at night the air in them is fresh and, in view of the fact that the children are not in the dormitories during the day, it would seem that in general the conditions should not necessarily cause ill health; however, it would doubtless be a much better practice to adhere strictly to the rule of allowing 600 cubic feet of air space per bed. In view of the above it is evident that more room in the way of new buildings or additions to the present ones should be provided in order to care for the present number of inmates.

Milk supply

The milk for this institution is supplied from the institution herd. The herd was recently tested for tuberculosis and was found in a satisfactory condition. As is required by the agricultural law samples are sent bimonthly to the Department of Agriculture for analysis and the results of these analyses indicate a milk of a satisfactory physical quality. The criticism previously offered regarding the facilities for cold storage apply also to the facilities for storing milk, for it is in this building that the milking utensils are cared for and that the milk is stored. A steam sterilizer is provided for sterilizing the milk pails and cans and, aside from the fact that the building is in an unsatisfactory condition making it necessary to store the milk with the meat and other supplies, no criticism is offered regarding the milk supply of the institution.

Since it is apparent from this investigation that certain insanitary conditions exist at the Thomas Indian School, I beg to submit the following conclusions and recommendations regarding sanitary improvements:

Conclusions and recommendations

1. That, in view of the unsatisfactory condition of the carpenter shop, cold storage and conduits between the main buildings, means be provided and new structures of a suitable type erected as soon as possible, and that, in the meantime, the present structures be carefully inspected by the institutional authorities at frequent intervals and such temporary repairs made as are necessary.
2. That, with respect to water supply, all cross connections between the domestic supply and the supply for fire protection, be eliminated; and that, in no case should taps or openings be allowed from which water might be obtained, for domestic purposes from the fire supply.
3. That since the method of sewage disposal was found unsatisfactory,

   (a) As recommended in the 1911 report on this institution " The sewerage system be altered in such a manner as to separate all sewage from rain water; and the domestic sewage properly treated before discharge into Cattaraugus creek.

4. That, in view of the overcrowded condition in some of the dormitories, suitable space in the way of either new buildings or additions to the present ones should be provided, in order that the rule of allowing not less than 600 cubic feet of air space per bed in the dormitories may be enforced; or that a less number of inmates should be cared for, at this institution.

Respectfully submitted,
THEODORE HORTON,
Chief Engineer

ALBANY, N. Y., *April* 23, 1915

State Custodial Asylum for Feeble-Minded Women (Newark)

HERMANN M. BIGGS, M. D., *State Commissioner of Health:*

I beg to submit the following report on an investigation of the sanitary conditions at the State Custodial Asylum for Feeble-Minded Women at Newark.

This report is based upon an inspection made of the institution by Mr. C. M. Baker, assistant engineer, on March 30, 1915. A similar investigation was also made in 1911, the report thereon being published on page 1010 of the annual report for that year.

Location and general description

Location — Village of Newark, county of Wayne.
Capacity — Eight hundred and fifty inmates.
Present popoulation — Inmates, 821; employes, 113; total, 934.
Area of grounds — One hundred and six acres.
Number of occupied buildings — Fourteen.
Class of inmates — Indigent, feeble-minded women who are residents of New York State.

Site of institution — The institution is located on the top of a hill, just east of the village of Newark, about 100 feet above the valley bottom. The valley at this place extends east and west and is about one mile wide, the institution being located on the south side. Passing through the valley are the New York Central and West Shore railroads and the Erie canal, while just to the south of the institution grounds, running north and south, is the Sodus Bay division of the Pennsylvania railroad. Ganargua or Mud creek meanders through the valley, finally emptying into Canandaigua outlet at Lyons. The site of the institution appears to be admirably selected, offering good drainage and excellent transportation facilities.

Buildings

The main building, in which are located the officers, is known as Building A. It has two wings, known as Buildings B and C, respectively, and in the rear of it is the laundry. Additional quarters for the inmates are provided by six cottages, known as D, E, F, G, H and I, respectively, and also by the hospital. Other buildings on the institution grounds include an employes' building, power house, green house, barns and other minor structures. The front part of the main building is four stories high, while the wings, known as B and C, and the cottages are two-story structures. Practically all of the buildings, except the barns, green house and carpenter shop are constructed of brick.

General physical and sanitary condition of the buildings — The present hospital and cold storage buildings are old, inadequate and unsatisfactory for the needs of the institution. Means are available, however, for constructing a new hospital, and, in fact, the contractor was just beginning work on it at the time of the inspection, but, although appropriations for this purpose have been asked of the Legislature by the institution authorities, apparently no means are now available for providing a new, nor for remodelling the present, cold storage. The tile floors in the main kitchen and bakery were broken in places and in need of repairs. So far as could be learned by the inspector, screens are not provided in all cases for the kitchens and dining-rooms during the summer months. The plaster was off from the wall in some places in the hall of Cottage E, and the ceiling plaster on the fourth floor of the main building was loose in places, due, the inspector was informed, to occasional leaks and overflows from the water tanks which are located in the attic.

Although, so far as could be learned, there is no seepage of water from the ground or surface water into the basement, cisterns are located in them under Buildings A, B and C, often causing dampness in them, the effect of which is at times noticeable in some of the rooms of the first floor over these basements.

Water supply

A dual system is now in use for supplying the water to this institution, water for domestic purposes being supplied from a spring 1½ or 2 miles south of the institution, and that for fire protection, boiler and laundry purposes from a surface supply, although this latter supply was formerly supplemented by pumping from the Erie canal. This practice had been discontinued sometime prior to the time of the inspection. There is a cross-connection between the two supplies which is provided with a back pressure,

or check valve, and also with a gate valve. The gate valve is left open and the check valve is assumed to prevent the flow of the surface water into the spring supply, but it is thus possible for the spring water to flow into the surface supply, providing this latter supply is insufficient to meet the demand. In case of a fire, however, necessitating the operation of the fire pumps, the water from the surface supply would be forced into the mains supplying the water for domestic purposes, providing the check valve did not close tightly or failed to operate satisfactorily.

The spring is located on a farm near a small settlement known as Marbletown. The farm on which it is located does not belong to the institution, but the institution owns a small area, possibly a lot 50 feet square, surrounding the spring. The spring is about 10 feet by 20 feet, and is enclosed with a concrete wall rising 2 or 3 feet above the surface of the ground. A house covers the spring and the doors of it were found locked at the time of the inspection. The conditions about the premises on which the spring is located were found unsatisfactory and a menace to the supply. This matter, however, was taken up by correspondence with the institutional authorities and the sanitary supervisor of the district on April 10. The letter addressed by you to the sanitary supervisor, a copy of which was also transmitted to the superintendent of the institution, described the conditions as follows:

"I find that this house (referring to the farm house) is located on rising ground above the spring and the slope is toward the spring. The privy back of the house is in an insanitary condition and in its present location is a menace to the supply. Even if the privy were placed in so-called sanitary condition, it is very possible that some menace would still exist, and I think that it would be well for the institution authorities to consider making some arrangement with the owner of this house to either locate his privy entirely away from its present position and in a location where any possible drainage would be carried away from the spring rather than toward it. It is possible also that a removable pail system might be installed whereby the contents can be satisfactorily disposed of entirely off the premises. The maintenance of such a system would have to be arranged between the institution authorities and the owner of the house.

Another feature in connection with the protection of this spring is that the land back of the house slopes towards the spring so that any slops or other polluted water thrown upon the ground would have a tendency to drain toward the spring. Proper drainage ditches should therefore be constructed between the spring and the house in order to deflect and prevent any surface pollution from reaching the spring. It is unfortunate that the institution, in purchasing this spring, did not secure more land around it. It is possible that in their deed or contract they may have provided for the maintenance of proper sanitary conditions and if not it would seem desirable that such arrangements be made for it is obvious that with the conditions as they are surrounding this spring there must always be a slight menace to the purity of it. In fact at the time of the inspection it was noted that the auxiliary well below the spring was out of order and the owner of the house was securing his supply from the spring itself, through means of an overflow. It would be very much better if no access whatever anywhere in the immediate vicinity of the spring should be had by any person except an authorized one from the institution.

"Although our report upon the recent investigation will be made later and transmitted to the institution authorities I believe that the menace to this spring warrants as prompt action as possible and it is my purpose to send a copy of this letter to the institution authorities in order that they may understand the situation and remove the menace that now exists. It is possible that they may wish to consult with you in the matter and with your understanding of the conditions and our views above expressed, you will be in a position to cooperate with them."

The surface supply consists of the drainage from the institution grounds which is collected in a reservoir and also was at one time augmented by pumping water from the Erie canal. Cisterns are located under some of the

buildings for collecting the water from the roofs. The surface supply is generally insufficient to supply the water necessary for the purposes for which it is being used and, therefore, at the time of the inspection, the spring water was also being used in connection with it.

Samples were taken of both supplies at the time of the inspection and sent to the Division of Laboratories and Research for analysis. The sample from the surface supply, is not representative of normal conditions because of the fact that spring water had been admitted to the reservoir. The results of these analyses together with those of other previous analyses are recorded in the following table:

NEWARK

DATE	Free ammonia	Albuminoid ammonia	Nitrites	Nitrates	Oxygen consumed	Chlorine	Total hardness	Alkalinity	Bacteria	B. Coli		
										10 c. c.	1 c. c.	1-10 c. c.
SPRING SUPPLY												
February 1, 1911	.044	.020	.004	0.40	0.50	3.75	757.0	212.0	300	−	−	−
December 4, 1911	.006	.032	.001	0.30	0.10	3.50	914.0	213.0	60	+	−	−
February 19, 1912	.008	.008	Trace	0.68	0.67	4.25	975.0	209.0	4	−	−	−
March 26, 1912	.004	.008	Trace	0.52	0.10	3.25	871.0	210.0	20	−	−	−
April 23, 1912	.002	.008	Trace	0.80	0.10	4.00	729.0	211.0	375	−	−	−
May 22, 1912	.004	.014	Trace	1.00	0.30	4.50	671.0	211.0	310	+	−	−
June 25, 1912	.004	.002	.001	0.78	0.10	2.75	700.0	211.0	80	+	−	−
July 24, 1912	.002	.003	Trace	0.72	0.10	4.25	729.0	213.0	25	+	+	−
October 16, 1912	.004	.010	.002	0.72	1.30	4.50	829.0	215.0	100	+	−	−
January 15, 1913	.012	.020	Trace	1.00	0.80	3.75	675.0	209.0	20	−	−	−
March 10, 1913	.002	.012	.001	1.00	0.70	3.50	586.0	199.0	475	+	−	−
April 23, 1913	.010	.018	Trace	1.30	0.10	4.13	478.5	208.0	140	−	−	−
May 20, 1913	.008	.016	.002	1.00	0.30	3.75	557.0	210.0	70	−	−	−
July 30, 1913	.004	.018	.002	0.80	0.70	2.12	743.0	212.0	25	−	−	−
October 6, 1913	.014	.012	.070	0.80	0.30	4.50	839.0	225.0	60	−	−	−
November 13, 1913	.006	.014	.001	0.60	0.60	4.00	771.0	214.0	90	+	−	−
December 13, 1913	.014	.010	.002	0.56	0.80	4.25	857.0	213.0	20	−	−	−
January 10, 1914	.006	.006	.003	0.70	0.80	4.50	871.0	210.0	15	−	−	−
February 7, 1914	.010	.004	.002	0.50	0.30	4.25	771.0	207.0	25	−	−	−
March 26, 1914	.014	.020	.001	1.00	0.50	3.75	800.0	210.0	50	−	−	−
March 30, 1915	.004	Trace	.001	0.70	0.70	4.00	378.5	211.0	5	−	−	−
SURFACE SUPPLY												
March 30, 1915	.168	.044	.005	0.160	2.30	8.00	614.0	184.0	120	+	+	−

Although the analyses of the spring water indicate in general a supply comparatively free from contamination, the comparatively high bacterial contents and the presence of the B. coli type in some cases indicate that at times pollution of a dangerous character has found its way into this supply, and it is quite probable, that this pollution is due to the insanitary condition of the surrounding premises on which the spring is located. As indicated by these analyses the spring water is excessively hard, the total hardness being about 700 parts per million and the mineral residue which, however, is not indicated in the above table, about 1,200 parts per million. This condition makes the water unsatisfactory for use in the boilers or hot water system and in fact for all purposes of washing or where a soft water is desirable.

The results of the analysis of the surface supply show the presence of considerable decomposing organic matter and also of bacteria of the B. coli type, and therefore indicate contamination, a condition, however, which is to be expected in a supply collected under similar conditions.

It is evident from the above that the present water supplies at the institution are unsatisfactory because

1. The supply consists of a dual system with cross connections between a badly polluted surface supply, unfit for domestic purposes and another supply being used for that purpose.
2. The supply for domestic purposes is subject to pollution and is excessively hard.
3. The present supply for fire protection, boiler and laundry purposes appears to be inadequate.

These conditions, however, have been recognized in part at least by the institutional authorities for some time and the development of a new supply is at present being considered by the State Architect and, in fact, this subject was previously discussed by this Department in a letter, replying to a request from the State Architect for information and recommendations regarding the development of a new supply at this institution.

In this letter it was pointed out that four sources were available from which it might be practicable to develop a satisfactory supply, namely:

1. Development of the present spring supply either by some method which will increase its yield or
2. By impounding one of the small streams southeast of the institution grounds.
3. Water pumped from Mud creek.
4. Water pumped from the Canandaigua outlet, the nearest point of which is some four miles south of the institution.

In all of these cases some method of treatment would have to be adopted; in the first instance, namely the spring supply in order to remove hardness and in the other three cases, in order to make the water safe from a sanitary standpoint, all of them being more or less polluted by sewage.

The various supplies were discussed in detail in this letter, the conclusions regarding them being substantially as follows:

The development of the spring supply would be somewhat impracticable because of its excessive hardness and the fact that there was some question whether the yield would be sufficient. Although from a strictly scientific standpoint it is possible to soften the spring water, there appears to be some question in the mind of the State Architect as to the practicability of such treatment.

The second proposition appeared to be impracticable because it would be necessary to construct an impounding reservoir and, even with this available for storage, there was some doubt whether the supply would be sufficient.

Concerning the other two sources, Mud creek and Canandaigua outlet; although it appeared practicable to develop a satisfactory supply from either, in view of the fact that the latter receives considerable pollution from sewage, the former source appeared the more desirable.

The letter in conclusion, therefore offered the following suggestion: "I would, therefore, suggest that studies be made by you for the development of the water supply for this institution embodying the use of Mud creek with an intake located at some suitable point above the village, this water to be pumped to the institution grounds and treated by sedimentation and the use of alum and mechanical filtration and sterilization. The quantity of this supply would seem to be unlimited so far as the needs of the institution are concerned and with properly designed treatment works, properly operated and installed, a safe and wholesome supply should be obtained. The hardness would be somewhat high but no more excessive than many other supplies for municipalities in this section of the State which have to rely upon these hard waters."

At the time of the inspection inquiry was made of the inspector regarding the feasibility of softening the spring supply for domestic purposes and developing a supplementary unpurified surface supply for fire protection,

boiler and laundry purposes. While this might be practical, such supplies are always attended by certain unsatisfactory features, as for instance, the possibilities of polluting the domestic supply through cross connections, a condition which at present exists at the institution and also the possibility of faucets being connected with the polluted supply and drinking water thus obtained from it. Such a system could be considered satisfactory only on condition that there was no cross connection between the two supplies and that no faucets nor openings were available from which water could be obtained from the polluted supply for domestic purposes. Consideration of the above supply would also necessitate an investigation to determine definitely whether the spring supply would be sufficient.

Plumbing

The plumbing has been renewed and repaired so that it is now practically all modern and in a satisfactory condition except in Cottage "D" where some of the obsolete plumbing with lead pipe connections is still in use. Aside from this criticism it is apparent that the plumbing system is satisfactorily trapped and provided with fresh air inlets and in fact, was generally in a satisfactory condition.

The type and number of fixtures appeared to be satisfactory except in a few cases where it is doubtful whether a sufficient number are provided for the number of people who use them. Thus on the third floor of the main building only four toilet seats are provided for 112 inmates and on the second floor of some of the cottages only three toilets are provided for 75 people. While other facilities are provided for these people in other parts of the institution for day use it is evident that more facilities should be provided for these places. Generally one toilet seat and one lavatory bowl should be provided for every 10 people.

Sewerage and sewage disposal

Most of the domestic sewage from the main building is discharged through 4-inch sewers into cesspools or basins which overflow into the main system. So far as could be determined by the inspector these catch basins are tight, allowing no seepage from them into the soil. Considerable trouble has been experienced with these 4-inch sewers especially those from the west wing of the main building because of clogging. In view of the fact that about 125 inmates live in this portion of the building the trouble is doubtless due to the fact that the sewer is too small for the grade on which it is laid. In any event it is apparent that the difficulty should be corrected.

The matter of sewage disposal at this institution has been the subject of numerous complaints and also of considerable action by this Department but, the objectionable conditions, which have been previously criticised, are now apparently entirely eliminated because of the fact that the institutional system is now connected with the village system. The agreement between the village and institutional authorities and plans for making the connection were submitted to and approved by this Department on October 7, 1913. The village is provided with a disposal plant, which is sufficient in size to also satisfactorily care for the institutional sewage at present, although it was pointed out in the report on the approval of the plans, that as the city and institution grew certain modifications or additions to the city plant would probably be necessary sooner than would have been the case providing the sewage from the institution were not discharged into the city system.

Storm water from the roofs and grounds is collected into the cisterns mentioned above or into a reservoir which furnishes the water supply for fire protection, boiler, and laundry purposes. As pointed out above, the location of the cisterns in the basement causes unsatisfactory conditions in the building, and it would therefore seem that the surface water should be cared for by some other method.

Garbage disposal

The kitchen garbage is collected in containers of a satisfactory type and fed to pigs. Ashes and other refuse is disposed of at a dump where a low place in the ground was being filled in or, is burned at the boiler house. The method of garbage disposal appears to be satisfactory.

Heating and ventilation

Heating — Both the direct and indirect systems of radiation are used in heating the buildings, in the more modern structures, the indirect system being used in the lavatories and toilets. Buildings A and C are equipped with the direct system except in a few cases where the direct-indirect system is used. Most of the other buildings are equipped with both systems. The heat is furnished by means of steam from a central plant and appears to be sufficient for present needs, although it is possible that when the new buildings now under construction are completed an addition to the present system will be required.

Ventilation — In connection with the indirect system of heating the fresh air is taken from outside buildings in all cases. The windows, however, are depended upon principally for ventilating the buildings.

Some cases of insufficient floor and air space in the dormitories were noticed. In dormitories No. 8, 12 and 13 only about 40 square feet of floor space or 470 cubic feet of air space are allowed per bed and in some of the dormitories in the cottages 40 square feet of floor space were allowed but only about 400 cubic feet of air space. In no case should less than 50 square feet of floor space and 600 cubic feet of air space be allowed per bed in dormitories in addition to which suitable day room space should also be provided; however, the present unsatisfactory conditions will doubtless be relieved when the new cottage, the construction of which was just being started at the time of the inspection, is completed.

Milk supply

The milk supply consists of about 350 quarts daily and is obtained by contract from two different dealers. The inspector was informed, however, that the supply really comes from three different sources. The dairies are inspected by the steward of the institution and also by the local health officer. The last inspection by the steward was made about six months prior to the time of this inspection of the institution at which time, so the inspector was informed, the condition of the dairies was found satisfactory. The herds supplying the milk have been tested for tuberculosis and found to be satisfactory. The milk is aerated and cooled at the dairies, is delivered to the institution every morning between 7:30 and 8:00 o'clock and is distributed immediately to the various buildings where it is stored in refrigerators. It would seem that, with the available facilities as indicated above and that, providing the method of producing the milk receives careful inspections and supervision by the institutional authorities the supply should be satisfactory.

It is evident from this investigation that certain insanitary conditions exist at the State Custodial Asylum for Feeble-Minded Women, and I therefore beg to submit the following conclusions and recommendations:

Conclusions and recommendations

1. That, in view of the unsatisfactory condition of the buildings in some respects

(a) A suitable building, adequately equipped, be provided for cold storage.

(b) In all places where the floor, walls or ceilings are in need of repair, such repairs be made without delay and that they be maintained in a satisfactory condition at all times.

(c) All cisterns in the basements and water tanks in the attics be abandoned.

(d) Suitable window and door screens be provided for all dining rooms and kitchens.

2. That, in view of the unsatisfactory condition of the present water supplies and the apparent need of a new supply adequate in quantity and satisfactory in quality.

(a) The institutional authorities have made a complete investigation of the sources and methods of developing a new and satisfactory supply, particularly along the lines suggested by this Department in the letter to the State Architect, the substance of which is recorded in this report; and that they proceed without delay to develop and provide a satisfactory supply of water for the institution.

(b) Pending the development of this supply, the present supply be protected from pollution, by maintaining more sanitary conditions in the vicinity of the spring, as recommended in a recent letter to the sanitary supervisor of the district, a copy of which was transmitted to the institutional authorities and a part of which is recorded in this report; also by eliminating all cross connections between the two present supplies and allowing no openings from the polluted supply from which water for potable purposes might be obtained.

3. That, in regard to plumbing:

(a) The plumbing in cottage "D" be renewed or remodeled to conform with modern practice.

(b) Adequate facilities be provided in all cases where they appear to be insufficient.

4. That in view of the inadequacy of the present 4-inch sewers they be replaced by larger sewers laid on an adequate grade.

Respectfully submitted,
THEODORE HORTON,
Chief Engineer

ALBANY, N. Y., *April* 23, 1915

New York House of Refuge (New York [Randall's Island])

HERMANN M. BIGGS, M.D., *State Commissioner of Health:*

I beg to submit the following report on an investigation of the New York House of Refuge at Randall's Island, New York city.

The inspection of the institution on which the present report is based was made by Mr. C. M. Baker, assistant engineer, on March 19, 1915. A previous investigation was made in 1911, the report thereon being published on page 1032 of the annual report of the Department of Health for that year.

Location and general description

Location — Randall's Island, city of New York.
Capacity — Eight hundred and fifty.
Present population— Inmates 855, employes 112, total 967.
Area of grounds — 37.5 acres.
Number of occupied buildings — Eleven.
Class of inmates — Boys from 12 to 18 years of age convicted of crime, vagrancy or disorderly conduct.
Site of institution — The institution is situated on Randall's Island, New York city, and is reached by means of the institution boat "Refuge" from the foot of 125th street.

Buildings

General description of buildings — The institution is separated into two sections, one of which was formerly used exclusively for girls but now, since no girls are received at the institution, this section is known as the primary division and cares for the smaller boys. The buildings in the main division consist of an administration building with wings extending to the north and

south of it. Enclosed within a wall, one side of which is formed by the three buildings mentioned above, are the north and south work shops, a building used for play and recreation and another used for mess hall and kitchen with a school located on the second floor over the mess hall. The main buildings of the primary division form the front of a similar enclosure in which are located a laundry and school house. Other buildings belonging to the institution include a power house, blacksmith shop, green house, barns, etc.

The buildings are brick structures and range from 1 to 4 stories high. Basements are provided under the middle section of the main buildings in each of the divisions.

Cells are provided for the inmates in the north wing of the main division, there being 88 of them arranged in two tiers on each of the first three floors, or a total of 264. In the south wing of this division and also in the primary division the cells are eliminated and dormitories provided.

General physical and sanitary condition of buildings — The buildings are old and it is apparent that in some cases repairs are needed. They were formerly equipped with obsolete brick cells but these have been removed and either cells of a modern type provided or the space used as a dormitory in all parts of the buildings now occupied. On the fourth floor of the north wing in the main division these obsolete cells are still in place but, there being an abundance of room in the institution, they were not being used at the time of the inspection. In fact, there is considerable such available space in the institution which by reconstruction can be satisfactorily used to increase its capacity and it is apparent that such a plan is being carried out, as the reconstruction of the fourth floor in the same division into a dormitory was in progress at the time of the inspection.

Unsatisfactory conditions with respect to the buildings were found as follows:

In the officers' quarters in the north wing of the main division the floors were in need of repair and the wood work and walls needed painting. The floors in one of the kitchens and also in the hall leading to the chapel were badly worn and needed repair. The calcimine in the chapel was peeling in places indicating leaks in the roof. The plaster was loose on the walls and ceiling at some places in the school room and although the light in this building appeared to be fairly satisfactory, it could be greatly improved by providing glass in the place of the wooden shutters now used in some of the ceiling ventilators.

Water supply

The institution is supplied with Croton water from the New York city mains. Two 10-inch mains are carried across to Randall's Island which supply the House of Refuge, and also the city Department of Charities which is located on the island. The Refuge is fed by a 7-inch main which discharges into two 4-inch mains. The branches are all 4 inches. When the lavatories are turned on, that is, at the time the inmates are washing for their meals, the capacity of these mains appears to be insufficient, it being necessary to start the fire pumps at that time to maintain sufficient pressure. A sample of the water was taken from a tap at the institution at the time of the inspection and sent to the Division of Laboratories and Research for analysis, the results of which together with those of other previous analyses are recorded on the following page.

While the result of the analysis of the sample taken at the time of the inspection indicates the presence of bacteria of the B. coli type in quantities as small as 1 c. c., the other analyses indicate in general a satisfactory supply and it is possible that the contamination of this one sample was due to certain local conditions or to pollution received while taking the sample or making the analyses. It may be stated that the Croton supply is known to be generally satisfactory and, therefore, it would appear that the supply of the institution should be of a safe quality as there is apparently no possibility of this supply becoming polluted in the mains at the institution.

RANDALL'S ISLAND

WATER ANALYSES

DATE	Nitrogen as — Free ammonia	Albuminoid ammonia	Nitrites	Nitrates	Oxygen consumed	Chlorine	Total hardness	Alkalinity	Bacteria	B. Coli 10 c. c.	1 c. c.	1-10 c. c.
November 12, 1910	......	......	......	......	......	......	......	......	325	+	+	−
February 15, 1911	.086	.156	.002	0.50	3.70	3.87	35.1	33.0	15,500	−	−	−
December 14, 1911	.048	.114	.003	0.24	2.79	4.50	40.3	35.0	40	−	−	−
January 15, 1913	.014	.104	.001	0.24	3.30	3.75	36.4	30.0	40	+	−	−
March 11, 1913	.012	.114	Trace	0.16	3.20	3.00	30.0	31.0	750	−	−	−
April 26, 1913	.024	.084	Trace	0.14	2.60	3.25	39.0	24.0	300	−	−	−
May 23, 1913	.012	.094	.002	0.16	3.00	2.75	36.4	30.0	250	−	−	−
July 24, 1913	.010	.092	.001	0.12	2.10	2.50	41.6	31.0	275	+	−	−
August 8, 1913	.026	.106	.004	0.10	2.80	2.50	39.0	34.0	5,100	+	−	−
September 9, 1913	.032	.144	.008	0.14	4.00	2.25	42.9	40.0	50	−	−	−
October 6, 1913	.024	.124	.003	0.10	2.60	3.25	50.0	36.0	180	+	−	−
November 11, 1913	.010	.136	.002	0.20	4.10	3.37	36.4	33.0	100	+	−	−
December 9, 1913	.016	.102	.002	0.24	4.10	3.50	39.0	30.0	125	+	−	−
January 12, 1914	......	......	......	......	......	......	......	......	140	−	−	−
February 10, 1914	.014	.088	.001	0.24	4.40	3.88	45.7	27.0	2,200	−	−	−
March 24, 1914	.016	.094	.001	0.24	4.60	3.50	35.1	30.0	160	−	−	−
September 2, 1914	.002	.048	.002	0.20	3.10	3.50	36.4	32.0	*25,000	−	−	−
March 20, 1915	.020	.044	.003	0.20	5.00	3.75	27.3	22.0	140	+	+	−

* Ice melted and water warm in container.

Plumbing

In general the plumbing is of the open type and appeared to be properly trapped and vented. Its condition appeared to be generally satisfactory at the time of the inspection except in regard to the number and condition of the fixtures, some of which were criticised in the previous report on an investigation of this institution.

The inadequacy of the number of fixtures is indicated by the following table, in the first column of which is shown the number of people and under each type of fixture in the other columns are given the present number and the total number that should be provided to furnish adequate facilities. It has not been attempted to record in this table all cases where the plumbing facilities are not satisfactory but only to indicate the general conditions.

LOCATION	Number of people	Toilet Seats: Present number	Toilet Seats: Required number	Urinals: Present number	Urinals: Required number	Lavatory Bowls: Present number	Lavatory Bowls: Required number	Remarks
NORTH SHOP								
Paint and advanced carpentry	34	1	2	......	1	......	1	....
Telegraph and tailor	66	1	4	......	2	......	2	....
Art and wood carving	52	1	3	......	2	......	2	....
SOUTH SHOP								
Machine shop	24	1	2	......	1	......	1	....
Carpenter shop	14	1	1	......	1	......	1	....
Shoe shop	16	1	1	......	......	......	1	....
NORTH WING-CELL BLOCK								
On each of three floors	88	3	6	1	2	3	3	Wash room adjoining for general washing.
SOUTH WING DORMITORY								
One each on three floors	150	4	10	1	4	......	5	Wash room for general washing.
SCHOOL								
Each of two divisions	290	1	10	......	4	......	5	....

The inadequacy of the present number of fixtures is particularly noticeable in the north shop. No urinals were provided and it would seem that, in order to maintain satisfactory conditions in the toilets, urinals of a satisfactory type, provided with proper flushing facilities should be provided in all cases. Although the general washing before meals is done in congregate washrooms certain facilities should also be provided in the toilets.

In the cell blocks located in the north wing toilet facilities are allowed the inmates except from 9 P. M. to 6:15 A. M., during which time they are locked in their cells. In the dormitories of the south wing toilet privileges are allowed at any time. The number of fixtures appeared to be insufficient in these places. Buckets are provided in each of the cells. They are taken out in the morning by the boys, emptied and rinsed at a slop sink and returned to the cells with a small amount of water remaining in them. They are sterilized weekly with either carbolic acid or chloride of lime. The buckets are made of enamel ware, but the enamel was off in many places and although they were provided with covers, holes were rusted through the covers in many places and, in fact, a great many if not the majority of these buckets were in an unsatisfactory condition.

The lavatory facilities in the general wash rooms consist of ¼-inch taps from a 2-inch main which discharges into a drain trough. At each tap is a soap rack which was provided with soap at the time of the inspection, a towel and a mirror. The plan is to provide an individual tap with soap and towel for each of the inmates but the inspector was informed that this is not entirely carried out; it being necessary for some of the boys to wash on the second shift. The boys wash at a given order and the flow of the water is controlled from a central valve by an attendant. The washing is done directly in the stream from the tap. These fixtures are constructed of galvanized metal and their condition appeared satisfactory at the time of the inspection.

Two outside toilets are located on the grounds of the main division. They are provided with trough water closets which are automatically flushed from the upper end, there being five or six seats thus connected and the flush passes successively from the upper to the next below finally discharging at the last one. It was noticed by the inspector that fecal matter usually remains in the lower end of this trough and it is therefore apparent that this method is unsatisfactory as compared with the single toilets; in fact this condition was criticised in the report on the previous investigation.

Shower baths are used for general bathing and appeared sufficient in number and satisfactory except in regard to the bath in the primary division, the floor, which is of wood, being in a very unsatisfactory condition at the time of the inspection. However, the inspector was informed that arrangements are made for repairing this place and, in fact, it was apparent that the work had already been begun. A concrete floor is to be provided and other necessary repairs in the piping and building are to be made. With these improvements properly carried out this bath will doubtless be in a satisfactory condition.

From the above it is evident that improvements in the plumbing facilities are needed in the institution in many respects.

Sewerage and sewage disposal

Both the domestic sewage and storm water are collected by combined systems of sewers which discharge into the river at five different places. The size and slopes of these sewers appear to be sufficient to meet local requirements, and since the method of disposal conforms to the common practice of disposing of sewage in this vicinity it does not seem necessary to recommend any changes now or until the larger question of disposal of the sewage of New York city is more definitely determined.

Garbage disposal

The kitchen garbage is collected in galvanized covered cans except at the main kitchen where covered barrels are provided. Most of this material is burned at an incinerator on the island. Ashes and other refuse is disposed of at a dump where low ground is being filled.

Heating and ventilation

Heating — Heat is furnished by steam from a central plant, principally by the direct system of radiation. It is apparent that the facilities are satisfactory for properly heating the buildings.

Ventilation — Ventilating ducts are provided to some extent but the windows are principally depended upon for ventilation, those in the dormitories being kept open most of the time during the day and part of them being opened during the night. The cells in the north wing are 4 feet 9 inches by 7 feet 8 inches and 6 feet 7 inches high with an open grating in the door, and in front of them is a 14-foot corridor, thus providing ample air space. The dormitories appear to provide sufficient space for the number of inmates they are accommodating. In fact, as previously mentioned, there is considerable available space at the institution which is not being used. One large dormitory to provide additional space was just being completed at the time of the inspection and is not yet occupied. It is estimated that when the total space available at the institution is made ready for use the total capacity will be approximately 1,000.

With the amount of space that is available at this institution little trouble should be experienced in maintaining satisfactory conditions in the dormitories and buildings with respect to ventilation, provided the windows are properly regulated.

Milk supply

The milk supply consisting of about 560 quarts of fluid milk daily is furnished from one of the dealers of New York City. All milk is pasteurized and the supply is under the supervision of the New York City authorities. Samples are sent semi-monthly to the Department of Agriculture, as is required by the Agricultural Law, for analyses and it is apparent from the results of these that the physical quality of the milk is satisfactory. In fact, with the supervision of the supply that is provided by the city authorities and also since the milk appeared to be properly handled and cared for after being received at the institution, it is apparent that the milk supply should be satisfactory.

In view of certain insanitary conditions which were found to exist at the New York House of Refuge, as pointed out in detail in this report, I beg to submit the following conclusions and recommendations.

Conclusions and recommendations

1. That, since unsatisfactory conditions exist in some of the buildings, with respect to the floors, walls and ceilings, as pointed out in detail above, the necessary repairs be made to eliminate these conditions and that the buildings be maintained in a good state of repair at all times.

2. That, in view of the insufficient numbers and unsatisfactory condition of the plumbing fixtures in some cases:

   (a) Adequate fixtures, including urinals, be provided in accordance with the requirements indicated in the body of this report.

   (b) As recommended in the previous report "The trough water closets used in the yard should be abandoned and modern individual flush closets provided."

   (c) The repairs being made in the general bathroom of the primary division be completed as soon as possible.

3. That, all the buckets in the cells which are badly worn and rusted, making it difficult to maintain them in a proper sanitary condition, be replaced by others of a suitable type.

Respectfully submitted,

THEODORE HORTON,
Chief Engineer

ALBANY, N. Y., *April* 21, 1915

New York State Hospital for the Treatment of Incipient Pulmonary Tuberculosis (Raybrook)

Hermann M. Biggs, M.D., *State Commissioner of Health:*

I beg to submit the following report on an investigation of the sanitary condition of the New York State Hospital for the Treatment of Incipient Pulmonary Tuberculosis at Raybrook. The institution was investigated by Mr. C. M. Baker, assistant engineer, on May 3, 1915.

Location and general description

Location — Raybrook, N. Y., county of Essex.
Capacity — 320.
Present population — Inmates, 300; employes, 100; total, 400.
Area of grounds — 512 acres.
Number of occupied buildings — 7.
Class of inmates — The inmates consist of persons affected with incipient pulmonary tuberculosis who are without funds.

Site of institution — The institution is situated in the Adirondack mountains on the Lake Placid branch of the D. & H. railroad between the villages of Saranac Lake and Lake Placid. The railroad passes through and the station of Raybrook is located on the institution grounds. The buildings with the exception of the power plant are situated on elevated ground about 40 or 50 feet above the elevation of the railroad and some 50 or 60 feet above Raybrook, a small stream which flows through the grounds just south of the railroad. The power plant is located below the railroad station between the railroad and the creek. The location is apparently satisfactory with respect to drainage and general surroundings.

Buildings

General description of buildings — The main building is a brick structure and consists of six parts which are connected by corridors and solariums. During the summer there are pitched some thirty tents for occupancy by inmates. These tents consist of wooden frame structures which are covered with canvas. The barns and other minor structures are built of wood.

General physical and sanitary condition of buildings — The general condition of the buildings at the time of the inspection was satisfactory and it is apparent that they are being maintained in excellent sanitary condition and that proper repairs are made when needed.

Water supply

The water supply is derived from a small mountain stream which empties into Ray brook. The intake which is located about two miles northeast of the institution consists of a small dam across the stream from which water is delivered through a main by gravity to a reservoir at the institution. Two reservoirs located at the institution, the smaller with a capacity of 25,000 gallons and the larger 1,000,000 gallons, furnish the only storage, there being practically no storage at the intake. The area of the watershed which lies on the side of the mountain where there are no inhabitants, is about one square mile. The only sources of contamination are, therefore from chance hunters or trespassers upon the watershed or from wild animals in the vicinity. The majority of the watershed is heavily wooded.

An estimate of the water consumption based on measurements made of the flow of sewage by the assistant engineer at the time of the inspection indicated a rate of 63,500 gallons daily from 10:50 A. M. to 1 P. M. and of 78,700 gallons daily from 2:10 to 3:30 P. M. These figures are probably equivalent to an average daily consumption at that time of approximately 50,000 gallons which would correspond to a per capita rate of 125 gallons daily. Measurements taken by the institutional authorities, however, at a

time during the summer when the consumption was at a maximum are said to have indicated a rate of 133,000 gallons daily or per capita rate of 332 gallons daily. Although no serious difficulty has been experienced, the engineer was informed that at times of continued drought the supply has been barely sufficient to meet the demand. As stated above the area of the watershed is approximately one square mile and although the flow of the stream at times of drought is possibly insufficient to supply the water needed, it would seem that with proper storage and conservation of the supply sufficient water could be obtained for the needs of the institution at all times. Therefore, should it be apparent in the future that there are shortages of water at certain seasons, it will be necessary to build an impounding reservoir at the intake or otherwise conserve or augment the supply.

Sewerage and sewage disposal

Although plans for the sewer system at this institution have never been approved by the Department, plans for sewage disposal were originally approved in 1903 (Vol. 24, p. 106, annual report) and plans for additions to the plant were approved in 1906 (Vol. 27, p. 663, annual report). Later an investigation of the operation of the disposal plant brought out the fact that it was inadequate and was operated unsatisfactorily, in consequence of which certain recommendations were made regarding improvements. Plans for alterations and improvements were therefore submitted to and approved by the Department in 1911 (Vol. 32, p. 577, annual report). Since these improvements were made, however, no investigation of the plant has been made until the present investigation of the sanitary conditions of the institution.

A system of sanitary sewers ranging in size from 5 to 10 inches in diameter collects the domestic sewage and conveys it to the disposal plant. The sizes of the sewers appear to be adequate. Manholes are not placed at all junctions but otherwise appear to be adequately provided.

The disposal plant as now constructed consists of two settling tanks with hopper shaped bottoms to facilitate the removal of sludge; a sludge bed, dosing chamber, 8 intermittent sand filters and 2 cinder filters which are used in place of the sand filters during winter. The effluent discharges into a tributary of Ray brook which empties into the Saranac river.

The settling tanks are divided into two compartments by means of a submerged weir and scum board. With an amount of sewage equal to 50,000 gallons daily, as indicated by measurements taken at the time of the inspection, the capacity of one of the settling tanks is sufficient for 3.1 hours and the other for 3.7 hours detention or by operating both together a detention of 6.8 hours may be provided. If, however, the sewage should reach an amount equal to the maximum water consumption, 132,000 gallons daily, which, however, is doubtful in view of the fact that at these times a great deal of water is used for sprinkling; the corresponding periods of detention will be 1.2, 1.4 or 2.6 hours. A portion of the sludge is drawn from the tanks each day and they are thoroughly cleaned three or four times monthly. The sludge is drawn from the settling tank to a smaller wooden tank about 2 x 4 feet in dimension by 2 feet deep whence it flows through a 12-inch cast iron pipe to the sludge bed. At times when the tanks are emptied the height of the water in the sludge bed causes the sewage to back up in the small wooden tank and overflow directly into the stream, and furthermore, due to insufficient capacity of the sludge bed, the embankment around it frequently breaks allowing the sludge to discharge directly into the creek.

The dosing chamber is 18.5 feet in diameter and is equipped with alternating siphons which discharge into a distributing manhole so arranged that any two of the beds can be dosed alternately. Each dose consists of about 6,500 gallons of sewage and the period of discharge is about 15 minutes. With an average of 50,000 gallons of sewage daily and two beds operated alternately each bed will receive a dose of sewage about every 6.2 hours and if the rate of flow is 132,000 gallons daily, every 2.4 hours.

The filters are divided into two groups, one consisting of four filters originally constructed in connection with the disposal plant, and the two cinder

filters, and the other of four filters more recently constructed. The effective size of the sand in the old filters is .16 mm. and the uniformity coefficient 3.00, while the effective size of the sand in the newer filters is .24 and the uniformity coefficient is 2.88. The total area of the sand filters is approximately .47 acres. The rate of operating the sand filters is thus about 85,000 gallons per acre per day for a water consumption of 100 gallons per capita or a total of 40,000 gallons daily. At the time of the inspection, however, the rate was about 100,000 gallons per acre per day while for the maximum water consumption, providing all the water finds its way into the sewers which is probably not the case, the corresponding rate is 283,000 gallons. It was stated that the beds are raked every four days.

Considerable trouble has been experienced in the operation of the filter beds because of their clogging, due doubtless, first, to inadequate grease traps to remove the grease from the sewage before it reaches the filters; second, to the fine sand from which the filters are constructed, and third, to improper care and operation with respect to cleaning the filters thus allowing grease, dirt and other foreign material to mix with the sand and clog the filters, and possibly also to an overtaxing of the sand filters by reason of an increase in the population of the institution.

As stated above, the sewage is passed through the cinder filters during the winter because, so the engineer was informed, it was believed impossible to operate the sand filters during this period. It would seem, however, that if the beds are thoroughly and properly prepared for winter use by furrowing and cleaning, they would properly take care of the sewage during the winter season.

The kitchen garbage is collected by a nearby farmer who conveys it to his farm and feeds it to pigs. An incinerator is provided for the burning of rubbish and similar material. Ashes, etc., are disposed of by filling in low portions of the grounds. The method of garbage disposal is apparently satisfactory.

Heating and ventilation

Heat is provided by steam from a central plant and so far as could be determined by the investigation, the amount of heat is adequate and the method of heating is satisfactory.

The ventilating facilities were found to be satisfactory in all respects, the air space ranging from 1,500 to 2,000 cubic feet per person in the rooms and wards.

Milk supply

Milk, amounting to about 550 quarts a day, is purchased from a dairyman at Peru, N. Y., about one-half of the milk being furnished from his own herd and the remainder from two other parties. The herds are tubercular tested, and at the time of the last test, which was shortly before this inspection, the herds were found in a satisfactory condition. The steward and the superintendent of the institution inspect the dairies regularly at intervals during the year, and the engineer was informed that the dairies are adequately equipped and in satisfactory condition. Physical examinations are made of the milk, as is required by law, by the Agricultural Department. So far as could be learned from the investigation it is apparent that the milk supply being furnished to the inmates of the institution is properly looked after and that it was in a satisfactory condition at the time of the inspection.

As a result of this investigation the only insanitary conditions found to exist at the State Hospital for Tuberculosis at Raybrook were in regard to the sewage disposal plant, and I, therefore, beg to offer the following recommendations to be acted upon by the institutional authorities:

1. That the sludge bed be enlarged and reconstructed so that it will adequately care for the sludge when it is drawn from the settling tanks and prevent the overflow of the sludge into the stream.
2. That adequate grease traps be provided to prevent, as far as possible, any grease from the kitchen from finding its way to the disposal plant.

3. That, regarding operation of the disposal plant:

(a) The filters be thoroughly cleaned and the surface sand removed to a depth of not less than 2 inches.

(b) When the surface of the filters shows evidence of clogging they be put out of use, the surface allowed to dry and the surface accumulations be removed and the beds otherwise be properly maintained; and that the practice of raking the filters be discontinued.

4. That, providing the above method of operation does not eliminate the trouble from clogging, additional filters be constructed and that they be provided with a coarser sand than that in the present beds.

5. That the sand filters be properly cleaned, furrowed and otherwise prepared, and used for the disposal of sewage during the winter months.

Respectfully submitted,

THEODORE HORTON,
Chief Engineer

ALBANY, N. Y., *September* 3, 1915

Rome State Custodial Asylum (Rome)

HERMANN M. BIGGS, M. D., *State Commissioner of Health:*

I beg to submit the following report on an investigation of the sanitary conditions at the Rome State Custodial Asylum located at Rome.

The inspection on which this investigation is based was made by Mr. C. M. Baker, assistant engineer, on March 31, 1915. A previous investigation and report regarding the sanitary conditions at this institution were made in 1911, the report being published on page 1058 of the annual report for that year.

Location and general description

Location — City of Rome, county of Oneida.

Capacity — Thirteen hundred.

Present population — Inmates, 1,500; employes, 220; total, 1,770.

Area of grounds — Six hundred acres.

Number of occupied buildings — Thirteen.

Class of inmates — The inmates of the institution consist of indigent, feeble-minded of both sexes, except able-bodied children between the ages of 7 and 14, who are able to use language, and feeble-minded women of the child-bearing age, the latter two classes are being cared for at other institutions of the State.

Site of institution — The institution is situated about 2 miles southwest of the city of Rome. The site is well selected on sloping ground which offers satisfactory drainage.

Buildings

General description of buildings — The main buildings form a connected group extending east and west about 1,400 feet, with two wings extending north and south about 200 feet. In addition to these there is also a power house, cold storage, mortuary, green house, barn and various other minor structures. Two farm colonies, located some distance from the institution proper, are also conducted in connection with the institution.

General physical and sanitary condition of buildings —All of the buildings, except the farm cottages, barns and a few of the other less important structures, are what is usually termed semifireproof brick structures. Except for a few minor repairs indicated below the buildings appear to be in a satisfactory condition.

In Building D, a three-story structure, a wooden stairway is much in need of repair and, in any case, it would seem that these stairs would be very unsafe in case of fire, and, therefore, that fireproof stairs should be provided. The floors in the dormitories at the Brush farm and in the laundry at the institution proper are in need of repair. The inspector was informed, however, that arrangements have now been made for providing a concrete floor for the laundry and that this floor is soon to be laid.

Water supply

The main water supply for the institution is derived from the water supply of Rome and is passed through pressure filters at the institution. The Rome supply is obtained from Fish creek, the watershed of which is sparsely populated and is also protected by rules enacted by this Department. It is apparent from recent information that the watershed is being regularly inspected, and it is reported to be in a satisfactory condition. With such a surface supply, however, there is always a possibility of indirect or of accidental, incidental or wilful contamination, due not only to those living on the watershed, but also to hunters and other persons traversing it.

The pressure filters were installed at the institution when the Rome supply was derived from another source which furnished a supply unsatisfactory in quality, and in view of the occasional turbidity which exists in the present supply, these filters have been continued in use. No alum is used in connection with the filters, and it is thus apparent that, as operated, they act largely only as strainers to remove turbidity, since, without alum, the bacterial efficiency of pressure filters is comparatively low.

Drinking water at the Brush farm is furnished from a well located near the house. The well is about 30 feet deep, is covered with a concrete platform and provided with an iron pump. The location of the well appears to be satisfactory, as there is apparently little opportunity for pollution. Soft water is obtained at this place from an infiltration gallery located on a flat near a brook about 150 feet from the building. The water is pumped from the gallery by means of a windmill into a stand pipe, whence it is delivered by gravity into the house. It is apparent that at certain times this supply is subject to pollution and, in fact, the institutional authorities do not consider it safe for domestic purposes, and, therefore, the well supply described above is used for that purpose.

Samples of the water from the various supplies were taken, including both the filtered and unfiltered, at the institution proper and sent to the Division of Laboratories and Research for analyses, the results of which, together with those of other previous analyses, are recorded in the table appended hereto.

The results of the chemical analyses from the filtered supply indicate, in general, a moderate amount of nitrogenous matter, a somewhat high figure for oxygen consumed, chlorine slightly above the normal and a low degree of hardness. The bacterial analyses indicate a bacterial content which, although at times running very high, is generally moderate, but not as it should be for a filtered supply. The B. coli type appears in a majority of 10 c. c. samples and occasionally in 1 c. c. samples. As pointed out above, the efficiency of the pressure filters, as operated, is comparatively low and insufficient to guard the institution against receiving water of an unsatisfactory quality at times, providing the raw water is occasionally polluted, and, therefore, a discussion of the quality of the water at the institution involves a discussion of the Rome supply. Information which has been obtained by this Department, and the general character of the Rome supply, indicate that, although it is not at all times dangerously polluted, there are frequently times when such pollution exists. It is thus evident that some more adequate form of purification is desirable in order to render the institutional supply safe and of a sanitary quality at all times. It is quite probable chlorination would satisfactorily and economically meet this requirement.

While it is apparent from the bacterial analyses that both of the supplies at the Brush farm were of a satisfactory quality at the time of the inspection, the location and possibility of the supply from the infiltration gallery becoming polluted at times render it unsafe for domestic purposes; and, in view of the fact that this water is piped into the house, with faucets from which drinking water might be obtained, it would seem that this supply and these conditions would offer opportunity for the inmates and employes to obtain a polluted water for domestic purposes. In fact the ease with which this water may be obtained, as compared with pumping the water from the well, would tend to encourage the practice of using this water instead of the well water. In view of the above it is evident that this supply

should be abandoned and either the well water supply depended upon entirely at this farm or the main supply be extended so as to include these buildings.

Plumbing

Although some of the plumbing has been installed for about 20 years, it has been recently overhauled and remodeled, so that now it is all in a very satisfactory condition. The drains and soil pipes appear to be properly trapped and vented and are apparently adequate in size.

The plumbing fixtures were satisfactory in type and were in good condition at the time of the inspection. It was evident, however, that in some cases an insufficient number are provided for the number of people who must use them. This condition was particularly noticeable in one of the wards of Building F, where only 4 toilet seats and 5 lavatory bowls are provided for 100 persons, and also in some of the wards of Building G, where there are only 4 seats and 2 bowls for 180 to 200 people. No urinals are provided in the toilets of the men's division. In fact the inspector was informed that, although these fixtures had formerly been provided, they had been taken out because of the difficulty of keeping them in a sanitary condition and preventing odors from them. While it is true that urinals of an insanitary type or, if neglected and not properly cared for, cause disagreeable odors and insanitary conditions, it would seem that the elimination of them would cause conditions at least as undesirable, if not more so. If, however, the urinals are of a satisfactory type and are properly cared for, no trouble should be experienced. In view of this it would seem that urinals of a satisfactory type should be provided in all toilets in the men's division. Plumbing fixtures should be provided in a ratio of 8 toilet seats, 2 urinals and 10 lavatory bowls per 100 persons in the men's division, and 10 toilet seats and 10 lavatory bowls in the toilets of the women's division per 100 persons.

In general the number of baths appeared to be sufficient, except possibly in one of the general baths, where only 6 showers are provided for some 400 people, or an equivalent of one for every 67 people. In general, with proper regulation of the bathing, and in view of the fact that a limited number of baths are also available on the wards, it is possible that no serious difficulty is experienced with these limited facilities, but it would seem that more baths are desirable.

Sewerage and sewage disposal

The domestic sewage is collected by a system of sanitary sewers which convey it to the disposal plant. The slopes and sizes of the sewers appeared to be sufficient, as little, if any, trouble has been experienced through stoppage.

The sewage disposal plant consists of a settling tank, dosing tank, sprinkling filter and final settling basin, and was recently made the subject of a special investigation by this Department, the report thereon being issued under date of January 27, 1915. This report pointed out that certain insanitary conditions existed regarding the operation and condition of the disposal plant and, therefore, offered the following conclusions:

> "1. Due to the character of the sewage which contains considerable grease, and to putrefactive action, very little sludge accumulates on the bottom of the settling tank, while the scum on the surface becomes very thick and would probably nearly fill the settling compartments within a year if not removed.
>
> "2 The flatness of the slopes of the bottom of the sludge chamber prevents efficient removal of sludge.
>
> "3 Due to the comparatively small openings, from the settling compartment to the sludge compartments, very little sludge is removed by means of the sludge pipes and therefore the capacity of the sludge compartment is not utilized.

"4. The dosing tank was not constructed according to the approved plans and the air lock dosing apparatus in the tank does not operate. As far as the inspector was able to ascertain it had never operated satisfactorily.

"5. Due to the continuous flow of sewage through the dosing tank and the low head on the nozzles of the sprinkling filter, the filter was giving a very unsatisfactory and unstable effluent.

"6 The final settling basin of earth shown on the plans does not appear to have been built, or at least to have been maintained, and the effluent from the filter does not receive any settlement in order that the suspended matter might be removed.

"7. The sludge field shown on the plans is not used and any sludge removed through the sludge pipe is discharged into the ditch receiving effluent from the filter."

Recommendations

As a means of correcting the above objectionable conditions, the following recommendations were offered:

"In view of the results of this investigation, I would recommend that the attentions of the authorities having charge of the institution be called to the conditions of the plant and to the necessity of making the following changes in construction and operation of the plant in order that a more efficient operation of the plant may be obtained. Since only one of the recommendations made in the report of 1912 has been carried out, the other three recommendations will be incorporated in these recommendations as they are essential in the proper operation of the plant.

"1. That the wooden partition separating the settling compartment from the sludge compartment be removed to allow the whole tank to be used as a settling tank, and that a wooden baffle, two feet wide, be placed directly in front of the influent pipes to interrupt any direct current of flow that might be started through the tank, and also that the scum board at the effluent end be extended down so that its bottom will be about 3 feet below the surface of the sewage.

"2. That the present air lock device in the dosing chamber be removed and that a simple automatic siphon be placed in the large dosing tank.

"3. That a final settling tank of concrete be built which should be divided into two compartments so arranged that one compartment may be used while the other is being cleaned.

"4 That a sludge bed of proper design and having sufficient area and capacity be constructed."

Since these recommendations had not been carried out, nor were means available for carrying them out at the time of this investigation, they are all still applicable to present conditions.

Cesspools receive the sewage from the Baily and Brush farm colonies. They are apparently satisfactorily located and appeared to offer little, if any, opportunity of polluting well waters. Although this is not so satisfactory as if these buildings were connected with the main sewerage system, in view of the fact that a comparatively small number of people are maintained at these places, they probably meet the necessary requirements at present.

Heating and ventilation

Heating — The heating of the main group of buildings is provided by steam from a central power plant. The detailed method of heating varies in the different buildings; in some indirect radiation is employed, the heat being driven into the wards by fans; in others direct-indirect radiation is used, the natural draft being depended upon to warm and ventilate the rooms; in still other buildings direct radiation is used with the radiators in the wards themselves. So far as could be learned by the inspector from

this investigation it was apparent that the heating facilities are adequate and that heat is satisfactorily furnished for all of the buildings.

Ventilation — In connection with the indirect system of heating the fresh air is taken from outside the buildings in all cases and, as indicated above, fans are provided in some cases to force fresh air into and draw the foul air from the rooms. Those wards which contain the patients known as low-grade patients, whose state of intelligence is at a minimum, and where unsatisfactory conditions are most unlikely to exist, are provided with a forced supply of heat and fresh air and an exhaust fan is also used in these cases to withdraw the foul air. This is particularly true in Building E. Buildings D, F, C and K are provided with the forced supply only, natural means being depended upon for drawing the foul air from the rooms.

Many of the wards were found to be badly overcrowded, thus allowing insufficient floor and air space. The following table illustrates this condition, although no attempt has been made to report all cases where such insanitary conditions exist:

DORMITORY	Number of beds	Square feet of floor space	Cubic feet of air space	Remarks
B-8, 12	70	46	52	Used as dry room and dormitory.
B-10, 11	108	44	28	Used as dry room and dormitory.
E- 4, 13	45	41	492	E-13 — low-grade patients.
F-3	43	29	348	
G-4	43	27	324	
G-5	47	33	396	
G-6	36	43	516	
J-14, 15, 16, 17	70	37	444	

Not less than 90 square feet of floor space and 600 cubic feet of air space should be allowed per bed in all dormitories and, in cases where the ventilation is inadequate, for low-grade or untidy patients, or for hospital purposes, additional space should be provided accordingly. In addition to the spaces in the dormitories, suitable day-rooms should also be available. From the table given above it is noticeable that in two of the dormitories, namely, F-3 and G-4, the floor space per bed is reduced to nearly one-half the amount that should be allowed, and in all the cases recorded above the figures are considerably below those which should be considered satisfactory. Although in B-2, 10, 11 and 12 the space is less than should be allowed for dormitories, these rooms are also used as day-rooms. It is very objectionable to use the same room both as a day-room and dormitory, even where more space is available, because of the difficulty of thoroughly airing the room at any time, either during the day or night. These overcrowded conditions are also indicated by the fact that the number of inmates in the institution at the time of the inspection exceeded the capacity by 250, or about 19 per cent.

It is evident from the above that more room should be provided at this institution, either by new buildings or additions to the present ones in order to satisfactorily care for the present number of inmates.

Milk supply

The milk supply is produced from the institution herd of about 150 milch cows. The herd is tested yearly for tuberculosis, the last test being made last November, at which time two of the cows were condemned and disposed of. The cows are maintained at three different dairy barns. These barns were inspected and found to be modern in type and in a satisfactory condition. The milk is taken directly from the barns to the creamery, where it is

placed in coolers. It was apparent from the inspection and investigation that the facilities for producing and handling the milk are satisfactory and that care is being taken to maintain the supply in a satisfactory condition.

Since this investigation has brought out the fact that certain insanitary conditions exist at the Rome State Custodial Asylum, I beg to submit the following conclusions and recommendations:

Conclusions and recommendations

1. That, although in general the conditions of the buildings were quite satisfactory, the following repairs or alterations are needed:

   (a) The old wooden stairs in Building D should be replaced by new ones which are fireproof.

   (b) The floors in the dormitories at the Brush farm should be removed and the work of placing a concrete floor in the laundry should be completed as soon as possible.

2. That in regard to water supply:

   (a) In view of the possibility of the city supply not being entirely satisfactory at all times, the institutional authorities should consider the question of sterilizing the institutional supply with liquid chlorine or by some other adequate method.

   (b) Because of the possibility of the water supply obtained from the infiltration gallery of Brush farm, which is at times undoubtedly polluted, being used for drinking water, this supply be abandoned.

3. That, in view of the inadequacy of the plumbing facilities in some respects, more adequate facilities be provided, where needed, and that urinals of a satisfactory type be provided in the men's toilets.

4. That in regard to the sewage disposal plant the recommendations made in the previous report on the special investigation, which are recorded above in this report, be carried out.

5. That, in view of the overcrowded condition of the wards, more room be provided, either by new buildings or additions to the present one, if the present number of patients are to be cared for.

Respectfully submitted,

THEODORE HORTON,
Chief Engineer

ALBANY, N. Y., *April* 30, 1915

RESULTS OF WATER ANALYSES

Abbreviations used to describe odors of water: 0, none; 1, very faint; 2, faint; 3, distinct; 4, decided; 5, strong; 6, very strong; a, aromatic, d, disagreeable; e, earthy; f, fishy; g, grassy; m, musty; v, vegetable

Municipality	County	Source of sample	Date of collection	Physical				Chemical (Parts Per Million)											Bacteriological			
						Odor		Solids			Nitrogen as —						Hardness			B. Coli Type + = present — = absent		
				Color	Turbidity	Cold	Hot	Total	Loss on ignition	Mineral residue	Free ammonia	Albuminoid ammonia	Nitrites	Nitrates	Oxygen consumed	Chlorine	Total	Alkalinity	Bacteria per c.c.; gelatin 20°, 48 hours	10 c.c.	1 c.c.	1-10 c.c.
Rome	Oneida	Tap, State Custodial Asylum	2/ 1/11	30	Tr.	....	....	52	....	28	.026	.060	.001	0.50	5.20	1.00	27.3	27.0	650	+	+	—
Rome	Oneida	Tap, State Custodial Asylum	12/ 7/11	30	Cl.	....	....	57	....	36	.012	.058	Tr.	0.20	5.20	......	26.0	21.0	50	+	—	—
Rome	Oneida	Tap, State Custodial Asylum	2/19/12	15	Cl.	....	....	54	....	31	.024	.086	Tr.	0.40	2.70	0.87	31.2	31.0	180	+	—	—
Rome	Oneida	Tap, State Custodial Asylum	3/26/12	30	Cl.	....	....	64	....	47	.004	.056	Tr.	0.40	2.60	0.25	28.6	20.0	400	+	—	—
Rome	Oneida	Tap, State Custodial Asylum	4/23/12	45	Cl.	....	....	26	....	21	.004	.056	Tr.	0.26	3.80	0.12	18.2	15.0	160	+	—	—
Rome	Oneida	Tap, State Custodial Asylum	6/19/12	30	Tr.	....	....	55	....	44	.004	.044	Tr.	0.16	3.70	0.50	35.1	32.0	400	—	—	—
Rome	Oneida	Tap, State Custodial Asylum	7/27/12	17	Cl.	....	....	74	....	52	.004	.026	Tr.	0.16	3.40	0.12	44.3	41.0	20	+	—	—
Rome	Oneida	Tap, State Custodial Asylum	10/16/12	55	Cl.	....	....	74	....	45	.006	.100	Tr.	0.10	8.40	0.75	39.0	28.0	100	+	—	—
Rome	Oneida	Tap, State Custodial Asylum	1/27/13	30	Tr.	....	....	47	....	35	.012	.058	.001	0.14	5.20	0.75	19.5	12.0	300	+	—	—
Rome	Oneida	Tap, State Custodial Asylum	3/ 5/13	27	Tr.	....	....	56	....	38	.010	.050	Tr.	0.24	3.80	1.00	27.3	21.0	700	+	—	—
Rome	Oneida	Tap, State Custodial Asylum	4/23/15	33	Cl.	....	....	31	....	20	.018	.062	Tr.	0.12	4.80	0.50	18.2	16.0	650	—	—	—
Rome	Oneida	Tap, State Custodial Asylum	5/13/13	20	Tr.	....	....	52	....	....	.006	.052	.001	0.06	3.20	1.00	32.5	28.0	11,500	+	—	—
Rome	Oneida	Tap, State Custodial Asylum	7/23/13	17	Tr.	....	....	62	....	45	.004	.062	Tr.	0.20	3.80	0.75	42.9	38.0	90	+	—	—
Rome	Oneida	Tap, State Custodial Asylum	10/ 4/13	20	Tr.	....	....	73	....	53	.008	.074	.001	0.02	4.20	1.25	47.1	42.0	230	+	+	—
Rome	Oneida	Tap, State Custodial Asylum	11/12/13	50	Tr.	....	....	56	....	33	.010	.110	.001	0.14	9.50	0.37	29.9	21.0	110	+	—	—
Rome	Oneida	Tap, State Custodial Asylum	12/10/13	40	Cl.	....	....	39	....	25	.010	.072	.002	0.16	8.10	0.25	24.7	20.0	450	+	—	—
Rome	Oneida	Tap, State Custodial Asylum	1/14/14	25	Cl.	....	....	53	....	36	.004	.052	.002	0.30	5.20	0.50	33.8	27.0	65	—	—	—
Rome	Oneida	Tap, State Custodial Asylum	3/24/14	20	Cl.	....	....	55	....	44	012	.058	Tr.	0.70	4.80	0.75	29.9	23.0	35	—	—	—
Rome	Oneida	Tap, State Custodial Asylum	3/31/15	10	2	....	....	52	....	42	.004	.040	.002	0.70	5.50	0.50	33.8	33.0	40	—	—	—
Rome	Oneida	Rome, supply, unfiltered	3/31/15	....	....	....	....	....	....	....	....	....	....	....	....	......	......	......	75	+	—	—
Rome	Oneida	Well supply at Brush farm	3/31/15	....	....	....	....	....	....	....	....	....	....	....	....	......	......	......	70	—	—	—
Rome	Oneida	Soft water supply at Brush farm	3/31/15	....	....	....	....	....	....	....	....	....	....	....	....	......	......	......	60	—	—	—

Craig Colony for Epileptics (Sonyea)

Hermann M. Biggs, M. D., *State Commissioner of Health:*

I beg to submit the following report on the sanitary conditions of the Craig Colony for Epileptics at Sonyea.

A previous investigation was made of this institution in 1911 (see 1911 annual report, State Department of Health, page 1050), at which time some insanitary conditions were found to exist, in consequence of which certain recommendations were then made concerning sanitary improvements relating to water supply, heating and ventilating, lighting and fire protection. Some of these recommendations have been carried out, while others, considered important, have not.

The present investigation is based upon an inspection made of the institution by Mr. C. M. Baker, assistant engineer, on August 10, 11 and 12, 1914. This report will deal with any matters brought out by the more recent investigation and found to require attention and correction, whether or not previous recommendations have been made regarding them. Since this is a reinvestigation of this institution, the report will necessarily contain much in the nature of a review of the previous work, and will cover matters directly or indirectly affecting the sanitary conditions at the institution, including location and general description, water supply, sewage and waste disposal, heating and ventilating, vital statistics, communicable diseases, organization and administration.

Location

Craig Colony for Epileptics is located at Sonyea, Livingston county, about 70 miles southeast from Buffalo and 40 miles south from Rochester. It is situated in the valley of the Canaseraga creek, which flows into the Genesee river about 3 miles farther down. The Keshequa creek, which empties into the Canaseraga creek, flows through the institution grounds, entering at the southwest corner and leaving near the southeast corner. The grounds, thus divided into an eastern and western portion, are connected by only one bridge. In the eastern section are the male quarters and in the western section the female quarters. The institution owns a total of 1,893 acres of land, the tract being, roughly, 1⅛ miles wide by 2⅝ miles long. The village of Mount Morris is situated about 3 miles northwest of Craig Colony. The Dansville and Mount Morris and the Pennsylvania railroads run through the northern portion of the institution property and have stations located on the grounds. The institution may also be reached over the Erie and Delaware, Lackawanna and Western railroads via Mount Morris. The elevation of the land varies from about 580 feet above sea level in the northern part to 820 feet in the southern part.

The soil is variable, being, in different localities, sand, clay or loam, while the subsoil may be gravel, clay or shale. The depth below the surface of the ground water varies from a shallow depth in the lowland in the southern part to 15 or 20 feet below the surface in other portions of the grounds. However, the drainage is, in general, good and no trouble is experienced from stagnant ponds.

Character and purpose of institution

The object of the institution is to secure the humane, curative, scientific and economical care and treatment of epileptics, exclusive of insane epileptics. Patients who are indigent and residents of New York State are received, providing they are not under 2 years of age. The average age of those at the institution is about 20 or 21 years. The period of detention is more or less optional with the relatives of the patients, but treatments of short duration are discouraged by the institutional authorities, it being considered satisfactory if an improvement in the condition of the patient is accomplished in 2 or 3 years.

Buildings and grounds

There are in all about 95 buildings, including the administration building, hospital, assembly hall, trade schools, power house, laundry, barns and about 35 cottages for patients, also 25 for officers and employes. All but four of the buildings where inmates are quartered and the more important of the

others are constructed of brick. The barns and other minor buildings are wooden structures. A few of the buildings are more than two stories high, but the majority of them consist of two stories and basement. The cottages are arranged in groups. The Villa Flora group, consisting of some 23 buildings on the west side of the creek, constitutes the group for females. The groups in the eastern section of the grounds, consisting of Industrial, Letchworth, West and Farnstead groups, furnish quarters for the male patients.

Attendance and mortality statistics

The rated capacity of the institution is 1,400. The population on October 1, 1912, was 1,418 and October 1, 1913, 1,427, while at the time of inspection there were present 767 male and 663 female patients, making a total of 1,430. It is thus evident that the institution is being crowded somewhat beyond its capacity. The number of employes at the time of the inspection was 114 females and 129 males, a total of 243, all of whom are quartered at the institution, thus making the total population at the time of the inspection 1,673.

The following table shows the number of deaths during the last four years, due to the principal causes, also deaths due to epidemic diseases:

	1910		1911		1912		1913		AVERAGE	
	Number deaths	Rate per 1,000	Number deaths	Rate per 1,000	Number deaths	Rate per 1,000	Number deaths	Rate per 1,000	Number deaths	Rate per 1,000
Epileptic causes	17	12.8	33	23.8	41	28.9	55	38.7	36.5	26.2
Tuberculosis	37	27.9	36	26.1	21	14.8	24	16.9	29.5	21.2
Pneumonia	30	22.7	29	20.9	35	24.7	24	16.9	29.5	21.2
Typhoid fever	0	0	0	0	9	6.3	2	1.4	2.8	2.0
Scarlet fever	0	0	1	0.7	0	0	0	0	.3	.2
Erysipelas	0	0	0	0	0	0	1	0.7	.3	.2
Various other causes	17	12.8	20	14.4	35	24.6	30	21.1	25.5	18.4
Total	101	76.2	119	86.0	141	99.3	136	95.7	124.3	89.3

The average death rate at this institution of 89.3 per 1,000 from all causes, as indicated by the table above compares favorably with that of the State hospitals for the insane, since statistics from all these hospitals over a period of three years, indicate an average of 89 per 1,000. It is probable that the general physical condition of the patients, due to their mental defects is about the same in each of these institutions, which, of course, is considerably below normal for the State. It is evident that the three principal causes of death are various epileptic causes, tuberculosis and pneumonia. Regarding communicable diseases, the following table lists the infectious diseases during the last four years:

DISEASE	1910	1911	1912	1913
Chickenpox	9	......	2	1
Diphtheria	......	55	8	3
Erysipelas	20	15	15	4
Influenza	42	79	24	34
Malaria	1	......	......	......
Measles	......	......	......	2
Scarlet fever	3	37	1	2
Tuberculosis	35	24	28	34
Typhoid fever	......	......	29	7

These statistics would indicate that typhoid fever is becoming somewhat prevalent and that in 1912 the disease took the form of an epidemic. However, the 29 cases during that year were all at the Loomis Infirmary, and the inspector was informed that the probable source of infection was a typhoid carrier who could not be definitely located. An epidemic of diphtheria occurred in 1911. An average of about 30, or 7 per cent., of the inmates are afflicted with some acute form of tuberculosis. Influenza also appears to be quite common.

General sanitary condition of buildings

Letchworth House, an old 4-story structure, is occupied by inmates. It is not fireproof and cannot be considered a safe structure for the class of inmates cared for at Craig Colony. The plastering is loose and falling in many places. An appropriation has been asked for by the institutional authorities for the purpose of erecting new cottages to care for these inmates and to remodel Letchworth House for employes quarters.

Mohawk apartment house for married employes was found to be in a very unsatisfactory condition. The building is old and much in need of repairs. The plastering was loose and falling in places. This building should either be put in good repair or other satisfactory quarters provided for these employes.

The laundry was recently partly destroyed by fire. An appropriation is available for rebuilding it, but at the time of the inspection the work of reconstruction had not been commenced.

In some of the other buildings the plastering was in need of repair. It is evident from the above that improvements are needed in the way of new buildings, in some cases to relieve objectionable conditions now existing, and in others to properly care for some certain classes of inmates, such as those temporarily insane. It also appears that more adequate quarters are needed for employes.

In general the basements were in good condition. The kitchen is located in the basement of some of the buildings and in some cases use is made of the basement for baths and in others for storage. At Chestnut cottage and Mohawk apartment house the inspector was informed that some trouble had been experienced with moisture in the basements, but at the other buildings the basements appeared to be dry.

The main cow barn was being remodeled at the time of the inspection. It is to be provided with concrete floors, good ventilating facilities and, in fact, is to be made modern in all respects. The other stables about the grounds were in a satisfactory condition. The manure, though not screened, is in all cases some distance from the main buildings and is evidently satisfactorily disposed of.

The grounds at the time of this inspection showed evidence of being well looked after and cared for. No insanitary conditions were noticed.

Water supply

The water supply is derived from two sources, the Keshequa creek and a spring or shallow well. The latter supply is used for drinking water and similar domestic purposes only, and the creek supply for all other purposes, including water for flushing closets, washing, fire protection, etc. Based upon estimates and information obtained from the engineer at the institution the total water consumption is approximately 300,000 gallons daily, about 20,000 gallons of which are furnished from the spring supply and the remainder from the creek. The water is distributed to the various buildings by a dual system. A standpipe, 15 feet in diameter by 75 feet high, with an inner shell 4 feet in diameter by 75 feet high, receives the water from the pumps. The inner shell, which has a capacity of about 7,000 gallons, stores the spring water, while the outer shell, with a capacity of about 90,000 gallons, receives the creek water. From the standpipe the water is distributed by gravity to the various buildings.

The Keshequa creek has a drainage area of about 78 square miles above the intake. The population on this area is about 4,000, the principal centers of which are Tuscarora, Nunda, Dalton and Hunts. The slopes are, in general, comparatively steep.

The spring or well is located in the flat about 750 feet northwest of the sewage disposal plant. Although the surface is quite level the drainage appears to be from the disposal plant toward the well. The direction of the ground water-flow is not definitely known, but in the case of a heavy draught on the well it is quite apt to be toward the well from the sewage disposal plant. The well is encased with a steel casing and is covered with a concrete cap or platform. Over it is a small building containing the electric pumps which force this water to the standpipe.

A sample was taken from each of the water supplies and sent to the Division of Laboratories and Research of Albany for analysis. These results, together with those of other previous analyses are given in the following table:

DATE	Nitrogen as —				Oxygen consumed	Chlorine	Total hardness	Alkalinity	Bacteria	B. Coli		
	Free ammonia	Albuminoid ammonia	Nitrites	Nitrates						10 c. c.	1 c. c.	1-40 c. c.
SPRING WATER SUPPLY												
June 14, 1910	......	......	......	......	......	......	......	......	140	+	—	—
July 7, 1910	......	......	......	......	......	......	......	......	3,400	—	—	—
July 7, 1910	......	......	......	......	......	......	......	......	1,900	—	—	—
October 28, 1910	.394	.092	.003	0.30	0.70	28.40	314.5	314.0	10	+	—	+
November 26, 1910	.400	.040	.001	0.24	4.80	34.50	260.0	......	9	—	—	—
June 13, 1911	.360	.048	.001	0.10	1.00	37.00	378.5	351.0	350	—	—	—
August 30, 1911	.510	.062	.005	0.30	1.50	38.75	378.5	378.0	3,300	+	—	—
September 12, 1911	.010	.026	.035	0.50	1.20	34.75	385.5	355.0	750	—	—	—
December 2, 1911	.384	.106	.005	0.10	0.50	35.00	393.0	384.0	30	—	—	—
February 19, 1912	.424	.066	.001	0.24	0.80	28.00	364.0	342.0	3	—	—	—
March 26, 1912	.260	.038	.004	1.08	0.10	28.00	300.0	288.0	20	—	—	—
April 22, 1912	.230	.028	.002	1.08	0.40	25.00	300.0	281.0	70	—	—	—
April 23, 1912	......	......	......	......	......	......	......	......	30	—	—	—
May 21, 1913	.292	.042	.003	0.68	0.80	29.25	293.0	289.0	20	—	—	—
June 18, 1912	.540	.034	.001	0.34	0.80	32.00	314.5	308.0	4	—	—	—
July 24, 1912	.348	.028	.001	0.60	0.30	31.00	307.0	340.0	17	—	—	—
September 16, 1912	.424	.030	.004	0.24	1.20	29.00	314.5	314.0	1,300	—	—	—
October 17, 1912	.416	.046	.001	0.34	0.80	26.00	390.0	323.0	30	—	—	—
November 5, 1912	.320	.056	Trace	0.30	1.00	23.75	325.0	287.0	70	—	—	—
January 25, 1913	.204	.024	.003	1.60	0.50	23.00	264.5	261.0	10	—	—	—
March 10, 1913	.258	.004	.001	0.90	0.70	28.75	300.0	284.0	60	—	—	—
April 22, 1913	.404	.004	.007	1.20	0.40	30.50	343.0	281.0	110	—	—	—
May 19, 1913	.388	.050	.005	1.60	0.50	36.00	321.5	284.0	50	—	—	—
July 23, 1913	.660	.056	.002	4.00	0.50	42.00	364.0	287.0	190	—	—	—
October 6, 1913	.750	.054	.001	4.40	0.40	47.00	407.0	297.0	900	—	—	—
November 12, 1913	.420	.026	.001	3.00	1.20	37.50	335.0	286.0	95	—	—	—
December 8, 1913	.480	.040	.002	2.50	1.10	38.00	350.0	289.0	550	—	—	—
January 16, 1914	.210	.032	.004	1.60	1.00	36.00	421.5	294.0	45	—	—	—
February 26, 1914	.800	.044	.002	0.50	2.50	36.00	307.0	293.0	35	—	—	—
March 24, 1914	.450	.030	.004	1.60	1.00	32.00	321.5	277.0	20	—	—	—
August 6, 1914	.580	.010	.003	3.20	0.90	38.75	335.5	295.0	1,000	—	—	—
August 12, 1914	.760	.006	.002	6.00	0.80	38.00	357.0	312.0	190	—	—	—
CREEK WATER SUPPLY												
June 14, 1910	.024	.074	.002	Trace	1.50	5.25	186.6	150.0	......	...	..	......
July 7, 1910	......	......	......	......	......	......	......	......	2,900	+	+	—
July 7, 1910	......	......	......	......	......	......	......	......	1,000	+	+	+
July 20, 1910	.032	.080	Trace	Trace	0.50	6.33	151.4	128.0	800	+	+	—
December 13, 1910	.004	.044	.001	0.20	0.40	7.00	188.6	133.0	125	+	+	—
January 11, 1911	.032	.114	.002	2.40	2.80	7.50	140.0	108.0	5,900	+	+	+
August 30, 1911	.324	.058	.005	0.24	1.90	8.87	314.5	310.0	6 400	+	+	—
December 2, 1911	.030	.088	.004	0.40	2.10	8.00	145.8	121.0	1,100	+	+	—
February 19, 1912	.006	.035	Trace	0.60	1.10	9.87	157.2	155.0	16C	+	+	+
March 26, 1912	.250	.028	.002	1.02	0.10	31.00	......	285.0	29	+		—
April 22, 1912	.152	.026	.007	1.02	0.10	19.00	293.0	222.0	500	+		—
April 23, 191	......	......	......	......	......	......	......	......	100	—	—	—
May 21, 1912	.012	.052	.001	0.24	1.90	9.00	154.2	139.0	600	+	+	+
July 18, 1912	.004	.032	.001	0.10	1.10	11.20	177.2	166.0	20	—	—	—
July 24, 1912	.002	.038	Trace	0.02	1.30	8.75	177.2	156.0	220	+	+	—
October 17, 1912	.184	.060	.001	0.16	1.00	18.00	312.0	259.0	140	+	—	—
November 15, 1912	.006	.068	Trace	0.06	2.10	7.75	180.0	152.0	300	+	—	—
January 25, 1913	.204	.054	.003	1.30	0.80	23.00	271.5	257.0	30		—	—
March 10, 1913	.004	.176	.015	0.50	8.10	8.25	......	......	120,000	+	+	—
April 22, 1913	.012	.048	.001	0.50	1.60	8.25	182.8	127.0	1,200	+	—	—
May 19, 1913	.388	.046	.005	1.60	0.60	36.00	328.5	285.0	70			—
July 23, 1913	.004	.046	Trace	0.04	0.60	8.75	188.5	156.0	650	+	+	+
October 6, 1913	.006	.036	.001	0.04	0.60	9.00	221.5	158.0	1,900	+	+	—
November 12, 1913	.008	.064	.001	1.00	3.10	7.00	171.4	114.0	2,300	+	+	—
December 8, 1913	.010	.040	.002	0.16	0.90	7.63	151.4	140.0	450	+	+	—
January 16, 1914	.010	.030	.005	1.00	1.70	2.00	214.5	130.0	550	+	+	—
February 26, 1914	.022	.040	.001	0.70	2.20	8.75	182.0	139.0	120	+	+	—
March 24, 1914									20			—
August 6, 1914	.004	.010	.001	0.02	1.50	8.50	208.0	156.0	24,000	+	+	—
August 12, 1914	.004	.004	.003	0.08	1.10	8.38	145.8	133.0	120	+	+	—

A special investigation of the water supply at Craig Colony, made in 1910 (see page 584, State Department of Health annual report, 1910), resulted in the following conclusions:

> "1. That the water supply taken from Keshequa creek is subject to considerable contamination from the communities on the watershed above the intake and at times has shown evidence of fecal pollution.
>
> "2. That the spring water supply, from the evidence of the analyses made at the State Laboratory, is at times contaminated, and that these analyses suggest the possibility of seepage from the nearby sewage disposal plant reaching the ground water of the locality.
>
> "3. That the use of a dual distributing system, one supplying water for drinking and culinary purposes and the second for other purposes, is to be deprecated on the ground that obviously the latter, or less pure water, would be frequently used for drinking because of carelessness, inadvertence or failure to distinguish between the two supplies."

From a study of the analyses of the spring water supply it is evident that: the free ammonia is generally high; the albuminoid ammonia and nitrites, while usually comparatively low, are at times much higher than would be expected in an uncontaminated ground water; the nitrates vary from 0.1 to 6.0, and are gradually increasing; the oxygen consumed is variable and occasionally high; the chlorine varies from 23 to 47, and is also gradually increasing; the hardness averages about 300; the bacterial count, while usually moderate, is at times quite high and the B. coli type usually absent. The high nitrates and chlorine, especially as shown by the more recent analyses, indicate considerable past organic pollution, and the fact that the series of analyses show a general progressive increase in these substances would also indicate a gradual increase in such pollution. In view of this fact it seems evident that seepage from the nearby sewage disposal plant reaches the ground water of the locality as was suggested in the report on the previous investigation in 1910, and, although it appears that the contamination thus reaching the springs has up to the present time been well purified by its passage through the soil, the fact that the amount of this contamination is increasing, and has already reached an excessive amount, raises a serious question as to whether this purification will continue to be as satisfactory in the future as it has been in the past, and whether the time has not already arrived when it will be safer to abandon the spring supply in favor of the purified Keshequa creek supply, a supply from other springs or, perhaps, wells conveniently located, but not subject to contamination by the sewage disposal plant.

Plans for a water softening and water filtration plant were approved by the Department on January 25, 1913, which provide for softening and filtering the spring water for domestic use and continuing the use of the creek as an auxiliary source of supply for this purpose and also for fire protection and flushing purposes where softened and filtered water is not needed. The existing force main from the pumps at the spring is to be intercepted near the elevated water tank, and the water pumped directly to the filter house to be located near the power house of the institution. The water to be supplied by this plant is estimated at 150,000 gallons daily.

In connection with the approval of these plans, the possibility of the unfiltered water being used because of the dual supply was pointed out, and also the necessity of using a coagulant when filtering the creek water, because of its high turbidity and active contamination. Certain criticisms were also made regarding the method of mixing the chemicals. In view of these facts the plans were approved upon the following conditions:

1. That mechanical stirring devices be installed in the solution tanks if necessary.
2. That all faucets and connections, except those connected with closet flush tanks and fire hydrants, of the present creek water system be removed.
3. That, in addition to lime and soda ash, a suitable coagulant be used when treating the creek water.

In view of the evidence, brought out by this investigation, and by recent analyses as pointed out above, that the spring water supply is being contaminated by seepage from the sewage disposal plant, and further, on account of the possibility of this pollution becoming active at any time, especially with the greatly increased draught from approximately 20,000 to 150,000 gallons daily, which is planned for by the new purification plant, it might seem advisable to consider at this time the abandonment of this spring water supply and substitute for it the creek supply effectively purified. In other words, the danger from the contamination of the spring supply should it ever become active, i. e., the purification of the soil ineffective, would be so much greater than any possible danger from the purified Keshequa creek supply that it would be safer to rely exclusively upon the purified Keshequa supply. This would require very little change in piping or other expense. As pointed out above, the area of the watershed above the intake is approximately 78 square miles which should or could be made to furnish an abundant supply of water.

Plumbing

In twelve or thirteen of the newer buildings the plumbing is of the open type but in the others the piping is enclosed in the ceilings and walls of the buildings. In seven of the cottages for females and four for males the piping is wrought iron with screw joints but in the other buildings it is cast iron with lead joints. Baths are not provided in all the buildings but a general bath is provided for each group, except that three or four of the cottages in the group for females are provided with tub baths. In one of these cottages, Kalmia, the tub had been disconnected from both water and sewer pipes during some repairs several months prior to the time of the inspection and had not yet been reconnected although it would require but a few minutes work to do so. This has necessitated the inmates from this cottage bathing at one of the other cottages. Aside from this evident neglect it appears that the plumbing and fixtures are being maintained in a satisfactory condition.

Sewerage and sewage disposal

Sanitary sewers collect the domestic sewage and convey it to the disposal plant. The storm water is collected by a separate system and is discharged into the creek or ravines at various places except that the rain water from the Villa Flora group is discharged into a cistern and furnished part of the water supply for the laundry. The size of the pipes for the sanitary sewers vary from four to twelve inches, the smallest size being used in some cases for house connections. The grades generally appear to be satisfactory except in a few cases where, however, the difficulty is obviated by flushing the sewer, in two places by the use of automatic flush tanks and in the others by regular hand flushing. Manholes are satisfactorily provided. The system was built in 1896 and has been added to from time to time as the institution has grown.

The sewage disposal was undergoing reconstruction at the time of the inspection according to plans approved by the State Department of Health in 1910. (See p. 473, 1910 annual report.) Originally the plant consisted of a screen chamber, dosing tank and three natural underdrained sand and gravel filter beds having a combined area of about three acres. The first of these beds was constructed in 1896 and the others in the two succeeding years. It is evident that the dosing tanks and filter beds were inadequate as to size and capacity to properly care for the sewage of the institution, and alterations were therefore considered necessary.

The alterations being made include the construction of a new settling tank and dosing chamber, the regrading of the three existing filter beds and the subdividing of them into 12 beds of 0.25 acres each. Two of these beds are to be used as sludge beds and for treating sewage while siphons are being cleaned. While at the time of the inspection the sewage was being discharged into the stream directly after sedimentation, the work of reconstruction appeared to be progressing satisfactorily and the new plant will doubtless be put into operation in a reasonable length of time.

Two isolated cottages for employes are provided with privies which appeared to be in fair condition at the time of the inspection. The toilet facilities at the brick yard consist of two or three privies located on the bank of a ravine which drains into the Keshequa creek. No vaults are provided for these privies. The dejecta is discharged directly on the slope toward the ravine, and is readily accessible to flies. Evidently no disinfectant is used. These privies are insanitary and should, therefore, either be abolished and some other sanitary method provided or they should be placed over suitable vaults and maintained in a more sanitary condition.

Garbage disposal

Covered galvanized receptacles are provided for receiving the garbage from the kitchens. This garbage, however, is collected daily and fed to pigs. Other refuse is disposed of at dumps in various remote portions of the grounds. Garbage that is considered infected is burned.

Heating and ventilation

The heating of the buildings is accomplished from several different plants. The central power plant furnishes heat for some nine or ten buildings five or six of which are buildings occupied by the inmates. The other buildings are heated in some cases by individual plants and a central plant is provided for five or six buildings. The administration building and some seven other buildings in the Letchworth group are heated by hot water with the direct system of radiation. Most of the other buildings are heated with steam and the direct system of radiation except that the indirect system is used in the infirmaries. The present arrangement appears to furnish sufficient and satisfactory heating facilities for the institution but there is some question as to the economy of the present system. It is understood, however, that a new central heating plant is being constructed which will more economically furnish heat for a majority of the buildings.

The tuberculosis pavilion and both of the infirmaries are provided with ventilating flues which act as outlets for the foul air. In the other buildings the windows are depended upon for ventilation.

In the following table are listed some of the cases of overcrowded dormitories which came under the observation of the inspector:

LOCATION	Size	No. of beds	Floor space per bed, square feet	Air space per bed, cubic feet
Patients cottage, Tulip Tree	14′ x 18′—12″	7	36	432
Patients cottage, Tulip Tree	14′ x 30′—12″	10	42	504
Patients cottage, Aster	16′ x 30′—10″	10	48	480
Patients cottage, Eglantine	16′ x 16′—12″	6	43	512
Patients cottage, Eglantine	12′ x 16′—12″	5	38	460
Schuyler infirmary	18′ x 20′—14″	10	36	504

The above is not to be considered as a complete list of cases where the dormitories are crowded beyond their capacity. In all cases the floor space should be not less than 50 square feet per bed and the air space not less than 600 cubic feet per bed. It is thus evident, from the table above, that some of the dormitories are very much overcrowded. This condition is also indicated by the fact mentioned above that the enrollment at the institution was thirty greater than the rated capacity at the time of the inspection. It is evident that more room is needed if the institution is to properly care for the present number of inmates.

Lighting

The buildings and grounds are lighted by electricity furnished by the institutional power plant. It was evident at the time of the previous inspection that the capacity of this plant was insufficient for the needs of the institution, in consequence of which the grounds were poorly lighted and likewise some of the buildings. This trouble, however will doubtless be eliminated when the new power plant under construction at the time of the inspection is completed and put into operation.

The windows appear to be sufficient in number and size also properly located to furnish sufficient natural light.

Fire protection

Due to differences of elevation at different parts of the grounds the water pressure varies from about 60 to 80 pounds. Hydrants are conveniently located near the buildings. Standpipes with hose attached on each floor are provided in all buildings occupied by patients. A central fire house is provided and equipped with 3 hose carts, 2 with 700 and 1 with 300 feet of 2½-inch fire hose, also a hook and ladder truck and 1 chemical engine. In addition to this equipment a hose cart provided with 350 feet of hose is located at the Farm group and also one with 250 feet of hose at both the Villa Flora and West groups. Fire extinguishers are sufficiently provided and conveniently located in all buildings. Fire escapes are provided for all buildings more than two stories high. In general it appears that the fire protection at the institution is quite satisfactory except at Letchworth House which has been previously criticised in this report. This building has insufficient fire escapes but as stated above the structure is not fireproof and is unsafe for mentally deficient patients such as are cared for at Craig Colony and other quarters should, therefore, be provided.

Foods

The milk furnished is from the institution herd of about 86 Jersey cows, part of them having been tested for tuberculosis by a representative of the Department of Agriculture in May, 1913, at which time three cows were condemned but when butchered were considered satisfactory for beef. It is the practice of the institution to have part of the herd tested for tuberculosis one year and the other part the next year, but if in the meantime there is any physical indication of disease the animal is tested. As previously stated the cow barn was being remodeled at the time of the inspection and when completed will be modern in all respects. In connection with this work a new milk house was being constructed near this barn. This building is to be divided into three parts, one containing the boiler for furnishing hot water and steam, another containing the sterilizing apparatus, etc., for sterilizing the milk pails, cans and other utensils and the third containing lavatory and toilet facilities. Semimonthly analyses of the milk by the Agricultural Department indicate that the milk is of good physical quality. It is evident from the above that the milk supply of the institution is satisfactory in quality and that proper precautions are being observed to keep it so.

The beef used is furnished on 6 months contracts and is delivered weekly to the institution. The pork used is raised at the institution. Butter and eggs are bought weekly in the open market. All meats, fish, butter and eggs are inspected personally by the steward. Other provisions are inspected by the storekeeper who reports to the steward. The supervisors of the various cottage groups also look after the foods received at the buildings in their charge. The provisions on hand at the time of the inspection appeared to be in good condition and those being served at the various dining-rooms were plentiful and satisfactory in quality.

The general storage for non-perishable supplies is in the same building as the bakery. The facilities and equipment here appear to be quite satisfactory and adequate. The cold storage, which is ice cooled, adjoins a small

ice house at Letchworth group, but the main ice house is about one-fourth mile distant. The ice is obtained from an artificial pond supplied with spring water. Only one cooler about 15 feet square is provided for meat, butter, eggs, etc. It is evident that these facilities are inadequate for the needs of the institution. Separate coolers should be provided for the various classes of foods and more room is needed. In fact it appears that a modern refrigerating plant would best meet the requirements of the institution. An appropriation for this purpose was made in 1912 but due to delays in preparing the plans and letting the contract it lapsed in 1914 and was not reappropriated. Effective efforts should be made by the institutional authorities to provide the much needed facilities for cold storage.

Meat is issued from the cold storage to the cottages daily and butter and eggs semiweekly. The foods from the general store house are issued weekly.

Culinary department

There is a total of about 28 dining-rooms each supplied from an adjoining kitchen. They are situated in different buildings throughout the colony and in some cases serve also the occupants of other nearby buildings. Table spreads are provided only for the employes and a few of the highest grade of patients. The dishes are earthen ware except in the infirmaries where because of the low grade of patients, aluminium or other metal dishes are provided. The waiters in nearly all cases are inmates who however appeared to render satisfactory service.

The kitchens appeared to be well equipped with the necessary ranges, utensils, etc. In some cases they are provided with concrete or tile floors and in others with hard wood floors. The dishes are washed by hand in all cases. It would seem that, especially in the larger kitchens, mechanical dish washers would more uniformly assure efficient sterilization of the dishes and that they would facilitate the work in this Department.

Although in general the condition of the dining-rooms and kitchens was satisfactory at the time of the inspection it was noticed that a number of them in the Villa Flora group while provided with window screens were not provided with door screens in consequence of which flies were numerous in them. All dining-rooms and kitchens should be completely screened and efficient precautions taken to eliminate flies from them. At Walnut cottage a toilet including flush closets is located over the pantry and kitchen. In the event of these closets becoming clogged and thus flooding the toilet unsatisfactory conditions might be caused in the pantry below, but it would seem that with proper precautions and regulations no direct menace to health should be caused from this source.

The bakery is located in the same building as the general store. It is well equipped with a mechanical mixer, moulder and divider also dough troughs, racks, etc. A separate room is provided for storing the bread. Separate lockers are provided for the clothing of those who work in the bakery. The toilet facilities are located in another part of the building. Conditions here appeared entirely satisfactory at the time of the inspection.

Laundry

As stated above the laundry had been partly destroyed by fire consequently the facilities in this department were limited at the time of the inspection, making it necessary to send part of the work to Rochester. However, since an appropriation is available for the necessary repairs and equipment this difficulty will doubtless be eliminated in the near future. Eleven women and two men are employed at the laundry in addition to about 40 women and 20 men who are inmates.

Cleaning

The cleaning is mostly done by the inmates although in some cases by employes. At the time of the inspection the institution appeared in a clean and neat condition indicating that this work is being well done.

Bathing facilities

In general each group of cottages is provided with a central bath, which is usually located in the basement of one of the cottages. Shower baths are used in most cases for the patients, except that four cottages in the women's group are provided with tub baths. The central bath for the Villa Flora group, located at Iris cottage, is provided with 6 showers for 140 patients, approximately one bath for every 27 patients. This bath is the most crowded of any but the conditions do not appear to seriously affect the opportunity for bathing. Baths are satisfactorily provided in the infirmaries and tubercular pavilions also in the hospital. The patients are required to bathe twice weekly and oftener if conditions require it. An attendant is regularly in charge of all baths given the inmates.

It is evident that satisfactory bathing facilities are also provided for the officers and employes at the institution.

Fresh air and exercise

About 55 per cent of the patients work which, in most cases, requires them to be out of doors a greater portion of the time. Five hours of school, Monday, Tuesday, Thursday and Friday are required of some of the inmates and 6 hours' work in the industrial schools are required on the same days for a part of the other patients. Those who do not work are given special exercises. It is evident that sufficient fresh air and exercise are required of the inmates in all cases.

Clothing and bedding

Most of the clothing for the inmates is furnished by the institution but is charged back to the counties from which the inmates come. Part of the clothing for the men and most of it for the women is made at the institution from cloth purchased from the Prison Department. Sheets, pillow cases and mattresses are made at the institution but the blankets are purchased from the prisons. It was evident at the time of the inspection that the clothing and bedding was being sufficiently furnished and that they were in a satisfactory condition.

Recreation

An extensive and well selected library at the institution is greatly enjoyed by many of the patients. A moving picture machine is owned by the institution and entertainments frequently given with it in addition to band concerts given by the institution band and various other amusements. Pianos and other musical instruments are provided for the inmates to some extent. The practice of giving entertainments at the institution is somewhat interfered with by the limited capacity of the assembly hall, the seating capacity of which is only 300. For this reason it is necessary to repeat an entertainment 3 times in order that those patients who are able to, may attend it. The hall at the institution is relatively smaller than such halls generally are in the state hospitals. As an illustration, Willard State Hospital with a population of 2387 has a hall with a total capacity of 1000 or a capacity equivalent to 420 per 1000 population. The corresponding capacity of the hall at Craig Colony is 210 per 1000 or one-half that at Willard and it is probable that a larger percentage of the population at the Sonyea institution is able to attend the entertainments. In view of these facts and also since, with the capacity of the amusement hall insufficient, there is probably a tendency to overcrowd it, the matter of providing a hall of greater capacity should be seriously considered by the institutional authorities.

Hospital facilities

Space and General Equipment — The hospital at the institution, known as Peterson Hosiptal, although fairly well equipped, evidently affords insufficient room to properly care for all inmates needing hospital treatment. There is one ward with a capacity of 17, for females, two with capacities of 10 each and one with a capacity of 8 for males also 12 single rooms, or a total capacity of 57. Under present conditions it is often necessary to care for various inmates, who are ill, at the cottages, when the work could be much more efficiently and better done at the hospital. The hospital appears to be satisfactorily provided with toilet and bathing facilities also with a dining-room and kitchen.

In addition to the Peterson Hospital two infirmaries and two tubercular pavilions are provided, one each for males and females. The former of these cares for the lowest grade of epileptics and both pavilions, as indicated by the name, care for tubercular patients. They appear to be fairly well equipped for the uses being made of them.

Equipment —The general condition of the beds, tables and other furniture in the various wards of the hospital appeared satisfactory when inspected. Rooms for the physicians and nurses are evidently satisfactorily provided.

Operating room —The operating room is provided with a tile floor and good light. The equipment in the way of sterilizers and instruments and the general condition of the room appeared satisfactory at the time of the inspection. Considerable criticism, however, was offered by the institutional authorities regarding the electrical and X-ray equipment which is located in another room. The person in charge of this work stated that only extremity work can be done with it, and that a more complete and modern apparatus is much needed by the institution in order that the necessary work in this department may be satisfactorily done.

Dispensary and drugs — A resident pharmacist is in charge of the dispensary which is conveniently located in the hospital. This Department appeared to be quite well equipped but evidently is somewhat limited for room. A drug cabinet is located in each of the cottages in which are stored certain medicines commonly used. These cabinets are kept locked and are in charge of the attendants at the cottages.

The drugs are purchased through the fiscal supervisor upon estimates furnished by the resident physician.

Nursing — Eight trained nurses are provided at the institution one of whom is the chief nurse and three of the others supervising nurses. There is also a training class composed of 6 seniors and about 15 juniors. In addition to the nurses there are 53 female and 41 male attendants who are in direct charge of the patients. Nurses are provided at each of the cottages. The chief nurse who is assisted by a sufficient number of attendant nurses, attends to the nursing at the hospital. It is evident that throughout the institution this part of the work is being well done.

Medical attendance — The superintendent of the institution is a physician of wide experience in the treatment and care of epileptics. He is assisted by first, second and third assistant physicians and four junior assistant physicians, also one woman physician. Six visiting specialists are also provided. A complete list of these physicians and specialists is given later in this report under "Organization and Administration". Daily written reports are required from the various departments to the superintendent, regarding the condition of the patients. Complete records are also kept at the hospital regarding the physical condition of the patients and the development of the various diseases.

Quarantine and disinfection — Two isolation buildings are provided, one for males and the other for females. They acccommodate six patients each, are divided into small rooms and appear to be satisfactorily equipped. Incoming patients are received in separate wards, the females in an old building formerly a school and the males in a separate ward of a building occupied by other inmates.

Upon admission the patients are examined by a physician who also takes cultures of the nose and throat. In cases where these cultures are found positive the patients are at once segregated and kept in quarantine until negative results are obtained on two successive days. The present plan is apparently successful in preventing communicable diseases from being brought into the institution by entering patients; however, a more comprehensive study of the mental and physical conditions of the patients could undoubtedly be more efficiently accomplished if a special reception building were provided, as the present equipment and arrangement are not conducive to the best results.

Pathological work and equipment — A separate building is provided for the laboratory. It is fairly well equipped but the work appears to be somewhat handicapped beccause no gas is provided, it being necessary to use alcohol or oil burners in all operations. Doubtless, however, this difficulty could be overcome by providing some special facilities in this department such as Barthels' Gasolene Bunsen burners. These are quite efficient and are frequently used in laboratories where gas is not available. It is also evident that, due to the increasing amount of work being done at the laboratory the space is becoming somewhat limited for satisfactory efficiency. The laboratory is in charge of a resident pathologist. The following list gives an idea of the character and scope of the work done:

Autopsies	97
Autopsies, histology	43
Autopsies, histories abstracted	96
Blood counts	50
Blood pressures	441
Physical examinations	26
Photographic work	3,073
Puncture fluids	3
Stomach examinations	2
Sputum examinations	42
Excreta for typhoid	57
Sugar tolerance tests	162
Sugar estimations	30
Throat examinations	871
Tissue diagnosis	2
Urine examinations	815
Vaginal smears	3
Widals	580
Wassermann tests	63

Organization and administration — The policy and management of the institution is controlled by a board of seven managers. The direction of the institution, however, is vested in the resident officers, of whom the medical superintendent is the chief executive.

Below is given a list of the board of managers and a partial list of the officers of the institution:

Board of managers

Frederick Peterson, M. D.	New York City.
Mr. Percy L. Lang	Waverly, N. Y.
Mr. Daniel B. Murphy	Rochester, N. Y.
Dr. Constantine McGuire	Brooklyn, N. Y.
George E. Gorham, M. D	Albany, N. Y.
Mr. Barney S. Beverlein	Mt. Morris, N. Y.
Louise Van Rensselaer	Albany, N. Y.

Resident officers

William T. Shanahan, M. D.	Medical Superintendent
G. Kirby Collier, M. D	First Assistant Physician
William M. Trader, M. D	Second Assistant Physician
Arthur L. Shaw, M. D.	Third Assistant Physician

James F. Munson, M. D.	Pathologist
E. Mabel Thompson	Physician
Elias Fischbein, M. D.	Junior Assistant Physician
Glenn J. Doolittle, M. D.	Junior Assistant Physician
James E. Haggerty, M. D.	Junior Assistant Physician
James H. Van Buren, M. D.	Junior Assistant Physician
Truman L. Stone	Steward
Mrs. R. E. Doran, R. N.	Superintendent of Nurses
Mrs. H. Mansfield, R. N.	Assistant Supt. of Nurses
Miss Ida E. Wright, R. N.	Matron
W. H. Beach, D. D. S.	Dentist

Resident chaplains

Rev. Walter B. McCarthy	Roman Catholic
Rev. J. R. Jeffrey	Protestant

Visiting staff

Rev. Dr. A. Blum, New York	Jewish Chaplain
A. G. Bennett, M. D. Buffalo	Ophthalmologist
Clayton M. Brown, M. D., Buffalo	Rhinologist, Octologist, and Laryngologist
William B. Jones, M. D., Rochester	Consulting Surgeon
L. W. Whitney, M. D., Rochester	Orthopedic Surgeon
Edward A. Sharp, M. D., Buffalo	Neurologist
Edward L. Hanes, M. D., Rochester	Neurologist

Administrative assistants

Bookkeepers	2
Storekeeper	1
Stenographers	3
Druggist	1
Teachers	5

In care of patients

Miss Catherine Murphy, R. N.	Chief Nurse at Hospital
Supervisor of cottage groups	7

Heads of departments

Edward M. Logan	Chief Engineer
Arthur J. Porter	Assistant Engineer
Heads of various other departments	16

As a result of this investigation, as pointed out in this report, certain unsatisfactory conditions were found to exist at the Craig Colony for Epileptics in consequence of which I beg to submit the following recommendations regarding certain sanitary improvements:

Conclusions and recommendations

1. In view of the unsatisfactory conditions and inadequacy of some of the buildings,

(a) That the use of the building known as Letchworth House for quartering inmates of the institution be discontinued and that other suitable quarters be provided instead.

(b) That Mohawk Apartment House be satisfactorily repaired so that it is in a sanitary condition or that other satisfactory quarters be provided for the employes now living there.

(c) That, the reconstruction of the laundry be completed as soon as possible.

(d) That, in all cases where the plastering of the buildings is in an unsatisfactory condition the proper repairs be made without delay.

(e) That in cases where water enters the basements, as at Mohawk Apartment House and Chestnut Cottage, the proper drains be constructed or repairs made to eliminate this difficulty.

2. That in view of the evident pollution of the spring water supply from the nearby sewage disposal plant, this supply be abandoned and the filtered creek supply used instead.

3. That the bath tub in Kalmia cottage be properly connected with both the water and sewer pipes, thus eliminating the necessity of these inmates bathing at another cottage.

4. That, in view of the insanitary condition of the privies at the brick yard, they either be abolished and sanitary toilet facilities provided or that the privies be placed over suitable vaults and maintained in as sanitary condition as possible.

5. That, since it was evident that a number of the dormitories were overcrowded, these unsatisfactory conditions be eliminated either by shifting a part of these occupants to other dormitories if sufficient room is thus available or if necessary by the construction of additional buildings to provide sufficient room.

6. That, in view of the inadequacy of the cold storage facilities, more room, properly subdivided, be furnished, or preferably that this difficulty be eliminated by the construction of a modern refrigerating plant.

7. That in view of the inadequate capacity of the assembly hall the matter of providing more satisfactory facilities in this respect be seriously considered.

8. Since it is evident that the capacity of Peterson Hospital is insufficient to properly care for the sick at the institution at all times, the institutional authorities should immediately take the necessary steps to provide the necessary additional room.

Respectfully submitted,

THEODORE HORTON,
Chief Engineer

ALBANY, N. Y., *January* 4, 1915

Letchworth Village (Thiells)

HERMANN M. BIGGS, M.D., *State Commissioner of Health:*

I beg to submit the following report on an investigation of the sanitary condition at Letchworth village at Thiells.

The institution was visited and inspected by Mr. C. M. Baker on April 22, 1915, and this report is based upon information obtained at that time.

Location and general description

Location — Thiells, county of Rockland

Capacity — Inmates, 100

Present population — Inmates 104, employes, 45, total 149

Area of grounds — 100 acres

Number of occupied buildings — 6

Class of inmates — The inmates at present consist of feeble-minded and epileptic males, but it is planned, with the development of the institution, to include both sexes.

Site of institution — The institution is located at Thiells station on the Erie railroad and is about three miles from Haverstraw on the West Shore railroad. The site of the institution is in the valley along the Minisceongo

creek. A large portion of the land is located on the mountains. The soil is very rocky and of an inferior grade, there being only a small portion in the valley which is suitable for agricultural purposes. Considerable of the territory is covered by new timber, the old timber having been previously cut and disposed of.

Buildings

The present buildings for inmates consist of two groups or colonies, known as the Secor and Disbrow colonies. Each of these colonies consists of a farmhouse, which has been remodeled and equipped, and is used as a kitchen and dining-room and also to accommodate a few employes; and a separate building of recent construction used as a dormitory for the inmates. The dormitory buildings consist of two wings or dormitories, with a central portion in which are located the plumbing facilities. The capacity of these dormitories is about 25 each, making the capacity of each colony 50. Other farm buildings have been remodeled and are being used as temporary quarters for some of the employes and also as administrative offices. A new building of modern structure is provided as a residence for the superintendent. The condition of the buildings, considering that they are wooden structures consisting principally of old farm buildings remodeled, was found satisfactory at the time of the inspection, it being apparent that they are maintained in satisfactory repair.

It is planned to develop the institution to the ultimate capacity of about 2,500 inmates and 500 employes. Four new cottages for inmates were nearing completion at the time of the inspection. They are modern in all respects and are constructed of stone which is obtained from the stone walls located on the grounds, the stone being dressed and faced before being used in the structures. These buildings will probably be ready for occupancy some time during the coming summer. The capacity of these new cottages is estimated at about 70 each. They are arranged in the form of the letter T, with two wings to be used as dormitories and a third wing to be used as a day or recreation room.

Water supply

The water supply is derived from the middle branch of the Minisceongo creek, the plans for the development of the supply having been approved by this Department on July 26, 1910, the report thereon being published upon page 429 of the annual report of that year. The source of supply is a reservoir formed by the construction of a dam near the junction of two branches of this creek and impounding some 21,000,000 gallons of water. The watershed, consisting of about three square miles, is unpopulated, although in 1912, at which time an investigation was made of the supply (see page 600, 1912 annual report), there was some property occupied by an undesirable class of people, which was located very close to the reservoir, and the recommendation was then made that this property be purchased by the institution. This has since been done. It is evident from the above that the water should, in general, be of a satisfactory quality, although there is a possibility of accidental, incidental, or wilful contamination from trespassers on the watershed, as is the case with all surface supplies. There is a wood road along the stream, extending through the mountains to another settlement, which, the inspector was informed, is used to some extent as a path or trail between the two settlements. It would seem, however, that this possibility of contamination is rather remote and, therefore, that the condition of the watershed at the time of the inspection was satisfactory. It seems advisable to point out the possibility of camps being formed on the watershed for the purpose of cutting the timber and the institution authorities, therefore, should at regular intervals make a careful inspection of the watershed to determine its condition and to prevent any possibility of contamination from this source.

Wells are also used to some extent, there being one located at each of the colonies and also one at Rose cottage, which is occupied by employes. The wells at the two colonies for inmates are 25 to 30 feet deep, are each covered with a concrete platform and provided with iron pumps. The principal sources of pollution in the vicinity of the wells are tile sewers, which in some cases pass comparatively close to them. The wells are also near the buildings, in which about 50 people live. The well at Rose cottage is a dug well about 40 feet deep, is curbed with stone to the surface, and provided with a concrete platform. Extending above the platform about three feet is a wooden curb. The well is equipped with a chain and bucket for drawing water.

Samples of the water from the various supplies were taken at the time of the inspection and sent to the Division of Laboratories and Research for analyses, the results of which, together with those of other previous analyses, are contained in the table appended hereto.

The results of the analyses of the water from the main supply indicate a satisfactory quality, as is shown by the small amount of organic matter present, the comparatively low bacterial count, and the fact that the B. coli type, although occasionally present, are not in excess of what might naturally be expected in a surface supply. The water is also very soft, but is rather high in color. The inspector was informed that considerable trouble had been experienced because of iron rust forming in the hot water pipes and tanks. This is a condition which often exists in connection with waters that are soft and high in color and may be due to the presence of iron in the water or to iron being dissolved from the pipes due to the presence of carbon dioxide in the water. The fact that a portion of pipe taken out a short time prior to the time of the inspection was said to have been badly corroded would indicate that the latter is the principal cause. It would hardly seem, however, that this difficulty is so serious that it cannot be obviated by flushing out the hot water tanks regularly at sufficiently frequent intervals.

The results of the analyses of the water from the well at Rose cottage indicate that at times the bacterial content is high and that bacteria of the B. coli type are present to some extent. This contamination is probably due to the method of drawing water from the well. The analyses of the water from the Disbrow well show excessively high chlorine, 74 parts per million. This might indicate saline deposits, but so far as is known there are no such deposits in this locality, and it is, therefore, probable that this high figure is due to pollution, possibly from some of the sewers finding its way into the well. The comparatively high nitrates, 0.7 parts per million, also indicate pollution and seem to bear out the above statement, but the low bacterial content and the absence of the B. coli type, also the low figures for free and albuminoid ammonia, indicate that the organic matter has been well oxidized and that the pollution has thus been made inactive in its passage through the soil. However, although inactive at present, this pollution may become active at any time and thus become dangerous. The bacterial analyses of the water taken from the Secor well indicate a comparatively high bacterial content for well water and show the presence of bacteria of the B. coli type, thus indicating active contamination.

It is evident from the above that, although it cannot be definitely stated that the well waters are dangerously polluted, there is the possibility of such pollution existing at times, and in view of the fact that the main supply is available at all these places, thus making it unnecessary to use the well waters, it would seem advisable to abandon the wells.

Plumbing

The plumbing at the institution has been recently installed under the supervision of the State architect and appeared to be satisfactorily provided with traps, fresh air inlets, etc. Its condition was satisfactory at the time of the inspection. The number, location and condition of the fixtures appeared to be satisfactory.

Sewerage and sewage disposal

The plans for sewerage and sewage disposal were approved by this Department at the time the plans for the water supply were approved and so far as could be determined by the inspection the construction has been carried out according to the plans as approved. The size and slopes of the sewers appeared to be satisfactory, no difficulty having been experienced from stoppages. Manholes are sufficiently provided and satisfactorily placed.

The disposal plant consists of settling tanks, sprinkling filters, settling basins, sludge tanks and sludge bed.

The effluent discharges into the Minisceongo creek. The ultimate capacity of the plant is to be such as will serve the full number of persons at the institution, namely, a population of 3,000, but at present only a part of the plant has been constructed and only a part of that which is constructed is now in use. A few days prior to the time of the inspection some one had stolen all of the nozzles from the sprinkling filters and, although the inspector was informed that others had been ordered by telephone, they had not yet arrived. So far as could be determined the plant has been operating quite satisfactorily. Complaint was made, however, of the care which is necessary in order to keep the nozzles from clogging, it apparently being the idea of the institutional authorities that the plant should run for one or two weeks at a time with no attendance or supervision. Another difficulty, which the inspector was informed had been experienced, was from the nozzles freezing during the winter, probably due in part to their clogging because of insufficient attention and partly because of the infrequency of the discharge due to the small number of people now connected with the system. The discharge, under present conditions, occurs only about once every hour during the daytime and possibly only once every two or three hours during the night, thus offering sufficient time for the pipes to freeze. This trouble, however, will doubtless be eliminated when the present number of inmates is increased so that the plant will operate under the conditions for which it is designed. It should be pointed out, however, that constant care and attendance is necessary to assure the satisfactory operation of any sewage disposal plant. The nozzles should be looked after and cleaned at least once each day, valves should be regularly looked after and, in fact, there are various details that need constant and regular supervision. It would seem that, in an institution of this character, this could be readily done by detailing some person, possibly an inmate of sufficient intelligence, to look after and care for the disposal plant.

Garbage disposal

The kitchen garbage is collected in suitable receptacles and fed to pigs. Other refuse is disposed of at dumps at different places on the grounds, or burned. No unsatisfactory conditions were observed in connection with the method of garbage disposal.

Heating and ventilation

Heating — The present buildings are equipped with individual heating plants, some of them being steam, some hot water, and some of the buildings are provided only with stoves. It is apparent, however, that the present facilities adequately heat the buildings now in use. Work was being commenced at the time of the inspection on the new power plant from which the new buildings will be heated and which will eventually provide heat and power for the entire institution. The new system of heating is to be hot water from the central plant.

Ventilation — The ventilation of the building is obtained through the windows and it was apparent that, if the windows are properly controlled, satisfactory ventilation should be obtained for all of the buildings. At the

time of the inspection, windows in all the dormitories were open and the rooms thoroughly aired. The space in the present dormitories is sufficient for the number of people they are accommodating.

Milk supply

The milk supply is obtained from the institution herd. The herd is tested yearly for tuberculosis, one cow being condemned at the last test, which was a comparatively short time ago. The dairy barn was inspected and found to be of a modern type and in a satisfactory condition; however, no milk house is provided in connection with it. The milk at the dairy is placed in cans provided with wooden plugs for covers. These cans are then distributed to the various buildings where the milk is placed in refrigerators and cooled. The milk cans are washed at the kitchens of the different buildings and the milk pails are cleaned at the farmer's residence. It is evident that the institution is much in need of a milk house, which should be satisfactorily equipped with proper facilities for cleaning and sterilizing the milk cans and utensils for collecting and handling the milk. The present cans are unsatisfactory, it being difficult, if not impossible, to maintain the wooden plugs in a satisfactory sanitary condition.

In view of the fact that certain insanitary conditions were found to exist at Letchworth Village, I beg to submit the following conclusions and recommendations regarding corrections that should be made:

1. In regard to water supply:

   (a) That, in view of the possibility of camps being constructed on the watershed of the main supply, the institutional authorities make regular inspections of the watershed at sufficiently frequent intervals to protect it from this form of pollution.

   (b) That, since it is apparent that there is a possibility of the wells becoming polluted at times, and since it is unnecessary to use them, they be abandoned.

2. That, since it is necessary to provide regular and efficient attendance to assure the satisfactory operation of any sewage disposal plant, such care and attention be provided for the disposal plant at the institution by detailing some person to look after it, clean the nozzles daily and give the plant the necessary attention and supervision to assure its satisfactory operation at all times.

3. That in order to adequately protect the milk supply:

   (a) A milk house properly equipped should be provided.

   (b) The wooden plugs now used as covers for the milk cans should be abolished and more suitable covers provided.

Respectfully submitted,

THEODORE HORTON,
Chief Engineer

ALBANY, N. Y., *April* 30, 1915

RESULTS OF WATER ANALYSES

Abbreviations used to describe odors of water: 0, none; 1, very faint; 2, faint; 3, distinct; 4, decided; 5, strong; 6, very strong; a, aromatic, d, disagreeable; e, earthy; f, fishy; g, grassy; m, musty; v, vegetable

Municipality	County	Source of sample	Date of collection	PHYSICAL				CHEMICAL (PARTS PER MILLION)											BACTERIOLOGICAL			
						ODOR		SOLIDS			NITROGEN AS—						HARDNESS			B. COLI TYPE + = PRESENT — = ABSENT		
				Color	Turbidity	Cold	Hot	Total	Loss on ignition	Mineral residue	Free ammonia	Albuminoid ammonia	Nitrites	Nitrates	Oxygen consumed	Chlorine	Total	Alkalinity	Bacteria per c.c.: gelatin 20°, 48 hours	10 c.c.	1 c.c.	1-10 c.c.
Thiells........	Rockland......	Tap from main supply......	1/25/13	33	Cl.	....	....	23	....	16	.024	.048	Tr.	0.02	1.20	2.00	3.2	2.0	100	—	—	—
Thiells........	Rockland......	Tap from main supply......	3/11/13	15	Tr.	....	....	32	....	13	.006	.050	.001	0.04	1.60	1.50	4.8	2.0	800	—	—	—
Thiells........	Rockland......	Tap from main supply......	4/25/13	15	Cl.	....	....	25	....	....	.004	.024	Tr.	0.02	1.90	1.75	20.8	2.0	50	—	—	—
Thiells........	Rockland......	Tap from main supply......	5/23/13	20	Tr.	....	....	32	....	15	.008	.034	.001	0.02	1.40	1.50	7.9	4.0	*—	—	—	—
Thiells........	Rockland......	Tap from main supply......	7/25/13	50	5	....	....	97	....	27	.006	.062	Tr.	0.02	1.20	1.25	15.6	7.0	50	+	—	—
Thiells........	Rockland......	Tap from main supply......	10/ 8/13	5	Tr.	....	....	27	....	22	.018	.066	.002	0.04	2.20	2.50	19.5	11.0	*—	+	—	—
Thiells........	Rockland......	Tap from main supply......	11/19/13	20	Tr.	....	....	20	....	17	.006	.036	.001	0.04	2.70	2.25	9.5	4.0	45	—	—	—
Thiells........	Rockland......	Tap from main supply......	12/10/13	15	Cl.	....	....	27	....	15	.006	.048	.002	Tr.	2.20	2.75	9.5	4.0	30	—	—	—
Thiells........	Rockland......	Tap from main supply......	1/15/14	12	Cl.	....	....	21	....	12	.005	.006	.005	0.04	2.20	3.00	11.1	4.0	30	—	—	—
Thiells........	Rockland......	Tap, from main supply......	2/ 9/14	15	Tr.	....	....	37	....	28	.008	.006	.001	0.04	2.00	2.50	9.5	4.0	50	—	—	—
Thiells........	Rockland......	Tap from main supply......	3/24/14	25	2	....	....	25	....	20	.004	.012	.001	0.04	1.40	2.25	9.5	4.0	15	—	—	—
Thiells........	Rockland......	Tap from main supply......	4/22/15	10	Cl.	....	....	15	....	10	.002	.018	.001	0.06	2.40	1.13	7.9	3.0	10	+	—	—
Thiells........	Rockland......	Well, Rose cottage......	3/11/13	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	2,900	+	—	—
Thiells........	Rockland......	Well, Rose cottage......	7/25/13	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	180	—	—	—
Thiells........	Rockland......	Well, Rose cottage......	4/22/15	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	30	+	—	—
Thiells........	Rockland......	Well, Disbrow Colony......	4/22/15	5	Cl.	....	....	218	....	168	.006	.004	.001	0.70	1.00	74.00	32.9	46.0	25	—	—	—
Thiells........	Rockland......	Well, Secor Colony......	4/22/15	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	170	+	—	—

* Delayed in transit.

STATE HOSPITALS FOR THE INSANE

Binghamton State Hospital (Binghamton)

HERMANN M. BIGGS, M. D., *State Commissioner of Health:*

I beg to submit the following report on an investigation of the sanitary condition of the Binghamton State Hospital, Binghamton, N. Y. The investigation was made on February 10, 11 and 12, 1915, by C. A. Howland, assistant engineer.

Location and general description

Location — Near the northeastern boundary of the city of Binghamton.
Certified capacity — 2110 inmates.
Present population — Inmates, 2,373; attendants, 476; total, 2,849.
Area of grounds — 1363 acres.
Number of occupied buildings — 29.
Site of institution — The main buildings of the institution are situated on elevated ground about 200 feet above the city of Binghamton, close to and within the northeastern boundary line. The State, however, owns three farms which are not a contiguous part of the main institutional grounds, the most distant farm being about 2 miles from the main buildings.

Buildings

General description of buildings — Of the 29 occupied buildings, about 13 are occupied by the patients continuously, and there are also some 12 or 13 rough log buildings close to the Susquehanna river which are occupied as a summer camp for convalescents. The employes and officers occupy about 12 buildings, and there is also an assembly hall, laboratory, 6 industrial buildings, power house and electric power station which is being removed. In addition to these there are barns, sheds and other necessary buildings.

General physical and sanitary condition of buildings — The walls of the buildings occupied by the patients are, with the exception of Edgewood, the tuberculosis pavilion, of stone, brick and concrete, but wood is used extensively in the interiors and the buildings are, therefore, only partially fireproof. All of the buildings of the outlying farms are frame structures, with the exception of part of one building.

The cellar of the main building is damp and poorly drained and poorly lighted by small windows located in areaways. The cellar of the frame house known as Parkhurst was also found to contain water, and it was asserted that the water sometimes rises in this cellar to a height sufficient to extinguish the furnace fire. In regard to the general condition of the interior of the buildings it may be said that while universal cleanliness prevailed, certain instances were found where repairs were needed. In Ward 5 the walls are in need of painting and the ceiling is in need of repair, and in Wards 6 and 26 the walls are in need of repair, especially in the toilet rooms, where painting is needed. In Edgewood, the tuberculosis pavilion, a composition material has been used on the bathroom floors and it was observed that this was cracked and worn in places. It has been replaced in some of the wards. The walls of Broadmoor are in need of paint to protect the plaster. A rat was seen by the inspector coming out of a hole in the diet kitchen of Ward 20 and the inspector was informed that rats were numerous in this building.

Water supply

On February 19, 1909, an examination of the water supply of the Binghamton State Hospital was made by a representative of this Department, with special reference to a proposed water supply to be obtained from driven wells. Subsequently plans for such a supply were approved by this Department, but it was pointed out that the water which would be obtained from these wells would be hard. In 1911 plans for an additional water supply were submitted because it had been found that the hardness of the well water detracted from its usefulness for laundry purposes. The additional water supply was to be obtained from the Susquehanna river and was to be filtered.

At the time of the present inspection it was found that the water works for the group of main buildings had been constructed in general accordance with the plans approved by this Department, although they differed from the plans in several particulars. The river water is obtained through a 10-inch intake pipe, which connects with a timber crib filled with loose stone and located 100 feet from shore. A screen having a ½-inch mesh is provided at the intake. The intake discharges into one end of a long suction well and infiltration gallery, the dimensions of which were given as 125 feet by 12 feet by about 4 feet deep at low stages of the river. This depth varies to flood heights when the water is over the pump floor above the gallery. The engineer was informed that there are 9 wells located in the bottom of the infiltration gallery; averaging in depth about 12 feet below the bottom of the gallery. Of the 9 wells, 7 are 6-inch wells and 2 are 48 inches. There are also 5 wells 6 inches in diameter and about 34 feet deep located outside of the filtration gallery. There is also said to be a 10-foot preliminary well.

Alum is used as a coagulant and is introduced into the water at the point where the river intake pipe discharges into it. The solution is mixed by compressed air and by the continued play of a series of jets on the alum in two circular wooden tanks which are about 36 inches in diameter by about 38 inches deep below the flow line. The solution is discharged into a porcelain-lined tank in which a constant head is maintained by means of a float valve. From the constant head-tank the solution passes through an orifice which is of the slot type and is controlled by a set screw. The orifice shown on the plans approved by this Department is not of this type.

The water is pumped from the infiltration gallery, where a short period of detention is provided, to two sedimentation basins constructed of concrete and about 17 feet 6 inches by 17 feet 2 inches in plan and about 11 feet deep below the water level. The inlet pipe extends across the end of the tank and discharges through several openings against the ends of the tanks. The tanks are baffled by three plank bafflles. From the sedimentation basins the water flows onto two gravity mechanical filters, which were built by the Continental Jewel Filter Company. They are constructed of concrete, each about 17 feet by 14 feet 6 inches in plan and contain about 3 feet of sand and 4 feet of gravel, laid over strainers placed in depressions in the floor of the filters. These strainers are constructed of brass and are flat cylinders with round holes in the top and sides. After filtration the water flows through two Venturi meters into a covered concrete clear water well located outside of the filter house. From the clear water well, which is about 40 feet by 40 feet by 8 feet deep, the water is pumped against a pressure due to static head of 160 pounds per square inch to the water mains and the excess flows into a reservoir located on the hill back of the institution. This reservoir is about 200 feet long by about 70 feet wide and 8 feet deep and its storage capacity is estimated at 700,000 gallons.

In regard to the operation of the plant it may be said that it is under the direct supervision of Mr. Burt R. Nelson, who is city chemist for Binghamton, and also chemist for the Hospital Commission. From Mr. Nelson, and from the engineer in charge of the plant, it was learned that the consumption of water at the institution, as measured by the Venturi meters at the filter plant, ranges from two-thirds to three-quarter million gallons per day, but for the year would average about three-quarter million gallons per

day. At the time of the inspection the combined meter readings gave a rate of about 530,000 gallons per day. The amount of alum used is given as from 0.6 to 1.5 grains per gallon, varying with the condition of the river and the amount of well water being used. Data gathered by the engineer check these figures.

For a rate of 530,000 gallons per day the period of sedimentation in the sedimentation basins is about 2 hours. The rate of filtration for the above consumption is about 48,000,000 gallons per acre per day, and for a water consumption of 750,000 gallons per day the rate of filtration is about 68,000,000 gallons per acre per day. The inspector was informed that the filters are washed at least once a day, and oftener when they need it. Loss of head gauges are provided to aid in determining when the washing has become necessary. The filters are washed by reverse flow of water, and the agitation of the sand is effected by air. From 2 to 4 per cent. of the total pumpage is used in washing and practically no water is wasted after the filters are washed.

Mr. Nelson informed the inspector that from analyses which he has made of the water he has found that the filters have an efficiency of from 97 to 99 per cent. Evidence of sewage has been found in the Susquehanna river raw water about two-thirds of the year, as determined by presumptive tests for B. coli in 10 c. c. samples, while gas-forming bacteria are found in 1 c. c. samples about 50 per cent. of the year. The engineer was informed that the esthetic qualities of the water have been disagreeably affected by the accumulation of muck in the reservoir, which cannot be readily cleaned. It would, therefore, appear that the sanitary quality of the water would depend, not only upon the percentage of well water which was being pumped, but also upon whether water was flowing through the mains from the reservoir, since this is in reality an equalizing and not a distributing reservoir. It appears from the above data that the rate of filtration for which these filters were approved by this Department, *i. e.*, 80,000,000 gallons per acre per day, has not been exceeded.

In addition to the water supply for the main institutional buildings, water supplies have been installed for the several farms where inmates who work on the farms are housed. At Orchard house, where a population of from 30 to 35 is served, the water is pumped from a driven well located in a brick building about 10 feet in the rear of the main building. The water is pumped by means of a gasoline engine to a tank in the attic, the pump being started and stopped automatically. The well is said to be about 100 feet deep and to be cased all the way down.

At Morningside a similar well and pump installation supplies water for this building, having a population of about 45, and also for Plymouth Rock, where a population of about 32 is housed. This well is similar to the other above described for Orchard house, being about 100 feet deep. The water is pumped into an attic tank. These attic tanks are open wooden tanks lined with galvanized iron. At Parkhurst the water supply is derived from a spring or infiltration gallery located at one side of a field lane used for cows. The gallery is rectangular and has walls which are stoned up at the bottom and built of concrete in the upper portions; the roof is of concrete. The chamber is about 7 feet by 15 feet in plan and about 8.5 feet deep. The water stands at varying depths in the bottom. A hill rises steeply to the west, while the ground to the east is flat, all of the surrounding land being under cultivation. The water flows by gravity to a pump in the cellar of the building and is pumped to a tank in the attic. The engineer was informed that the spring chamber is cleaned out about twice a year, it being necessary to remove the sand and silt which seeps in through the stone. A railing has been placed around the spring.

The institution maintains a camp close to the banks of the Susquehanna river, near the Plymouth Rock farm, and from 40 to 50 convalescent patients are kept here for varying lengths of time in the summer. The water for the flush closets at this camp, and for other purposes except drinking, is pumped from the Susquehanna river, the point of intake being more than a mile above the intake of the water supply of the main buildings. The water is pumped into an iron boiler, which has been set up back of the camp.

The inspector was informed that improvements are to be made in this water supply, especially with reference to this boiler reservoir. The drinking water for the camp is said to be brought in cans from Plymouth Rock and, therefore, comes from Morningside.

In the several wards iced water is furnished to the inmates in the summertime, almost invariably from wooden kegs which are painted white and fitted with a faucet. A common drinking cup or glass is used. Although the providing of proper drinking water facilities is a difficult matter in an institution of this kind, it would seem that the installation of drinking fountains for the use of the inmates would provide them with drinking water in a much more sanitary manner and would also be a greater safeguard against the spread of communicable diseases.

Samples of the several water supplies used at the buildings of the institution were analyzed by the Division of Laboratories and Research and the results of the analyses are included in the table attached to this report, and a review of the results of these analyses indicates that under conditions of proper operation of the water treatment plant the water supplied to the main institution buildings is of satisfactory sanitary quality. The apparent efficiency of the filters, bacteriologically, evidently depends to a considerable extent upon the relative proportion of ground water which is being used and the chemical constituent of the water is affected by the same factor.

In regard to the well waters used at the farm buildings, samples of which were collected by the superintendent of the hospital, the results of the analyses are not dependable, since the samples when received were not iced, and the very high bacterial counts indicate a probable increase in numbers of bacteria in transit. B. coli were found in both the ground water supplies used at Orchard house and at Parkhurst, while the Morningside results show an entire absence of B. coli. It would, therefore, appear that the water supplies of the two first mentioned farm buildings is of a suspicious sanitary quality, and that steps should be taken to provide a safe water for these buildings. It is well known that the Susquehanna river water is grossly polluted and its use at Pine Camp, without purification, even for flushing closets and washing purposes alone, cannot be considered safe, since it is obvious that the inmates may thoughtlessly or accidentally use the water for drinking and a serious epidemic of typhoid result, unless the patients are of such a class as to require constant attention, in which case the danger is lessened, but still exists. The previous experience of the institution with typhoid fever indicates the danger of using the river water.

The results of the analyses of the water supply of Parkhurst support the results of the inspection of the sanitary surroundings of the spring or infiltration gallery which, as previously stated in this report, showed that the source was exposed to pollution from several sources. Although the driven wells, from which the supplies of Morningside and Orchard house are taken, are similar both in construction and location in relation to the buildings, the results of the analyses of these two supplies indicate a difference in their sanitary quality at the time of the collection of these samples. The investigation of the surroundings of these wells, the details of which have previously been stated in this report, show that the soil surrounding the wells is subject to extensive pollution, not only through leakage from the sewers of the places, but also through any leakage which might take place from the privies. Orchard house is located on flat land adjoining a stream, while Morningside is located on a hill, and it would, therefore, be expected that the effects of the pollution of the subsoil would be more marked at Orchard house than at Morningside and would probably be apparent at the former place at times when they would not be apparent at the latter. It is reasonable to assume, therefore, that not only Orchard house, but also Morningside, is using a water supply which is in danger of serious pollution and that steps should be taken to properly protect these supplies.

Plumbing

General type — The plumbing of the several buildings of the main group is of varying degrees of age and, consequently, in some of the older buildings is not of the most modern type, and, although every effort is apparently made

to keep it in a good state of repair, yet some of it is open to criticism. It may be said that in general the plumbing is of the open type. It may also be said that in general vent stacks are installed and that the several headers for a series of fixtures are usually vented into these and the vent stacks are connected with the soil stacks before the latter are carried through the roof. Frequently, also, each fixture will not be trapped, but the header will be trapped near the soil pipe and the other end connected with the vent pipe. This practice is open to the criticism that a sudden discharge of water through the soil pipe might siphon the trap. Such a system is usually found, however, on soil stacks which receive lavatory wastes and, therefore, the probability of such a slug of water occurring in the soil pipe is reduced. This is the case in Fairmont.

In the West building, which is one of the older ones, in the toilets of Ward 34, galvanized iron basins are installed, which is also the case in Ward 28 of the South building. All the fixtures in the West building are not vented, but, as stated above, the plumbing is old. Aside from the galvanized iron fixtures, which do not wear as well as porcelain ones, the general criticism may be made that the plumbing of the South building is in need of a general overhauling, since it is not only old, but is largely placed inside the walls of the building and is, therefore, difficult to repair.

In the East building several of the pipes were found to be in the walls, and in Ward 26 it was found that the wash basins are not vented. The lavatories in some of the wards were chipped and not in a good state of repair. In Ward 8 a trough urinal is provided and this is flushed by an automatic tank, but it was apparent from the odor that this did not operate often enough. The plumbing of the North building is partly open and partly enclosed in the partitions.

In general the fixtures are adequate for the number of patients which would, under proper conditions, be in the several wards, that is, the number of fixtures is adequate for the certified capacity of the wards in most instances, but as many of the wards are overcrowded, the number of fixtures is not adequate for the present number of patients using them, as shown by the following table. Therefore it is evident that the capacity of the institution should be increased in such a way that the congestion in certain wards will be relieved. No attempt has been made to include in the following table all of the instances where it was found that the number of fixtures is not adequate for the number of patients using them, and in some instances the proper adjustment will be obtained by decreasing the number of patients, rather than increasing the number of fixtures.

WARD	Number of occupants	Toilet Seats		Urinals		Lavatory Bowls		Remarks
		Present number	Required number	Present number	Required number	Present number	Required number	
2	39	3	4	1	1	4	4	......
3	58	3	6	1	1	4	6	......
7	74	3	7	3	......	3	7	......
12	59	3	6	2	......	3	6	......
14	63	4	6	2	......	3	6	......
22	55	3	5	......	......	4	5	......
23	64	3	6	......	......	4	6	......
26	97	5	10	......	......	4	10	Used in common.
27	97	6	10	......	......	3	10	
46	67	4	7	2	......	6	7	
Kitchen	40	1	4	......	......	......	......	......
Broadmoor	......	......	......	......	......	......	......	......

From the above table it will be seen that for the present populations in the wards inadequate fixtures have been provided for the number using them in all of the wards listed. In Wards 3, 7, 12 and 23 only half of the required number of toilet seats have been provided and the lavatories also show a like deficiency.

Sewerage and sewage disposal

The sewers of the institution are all combined sewers which discharge the sewage and storm water into the sewerage system of the city of Binghamton at a point near the southwestern corner of the grounds. The main outfall sewers pass along the bank to the north of the flat area in which some of the wells of the public water supply are located, but, as previously pointed out in the report on a previous inspection, there is probably little danger of the pollution of these wells by sewage from these trunk sewers because of the nonporous nature of the soil in which the sewers are laid. Trouble has been experienced with clogging of the sewers, due to cloths and other substances which are introduced into them by the inmates, and the engineer was also informed that accumulations of gravel in the main trunk sewer had also given trouble.

An examination of the plan of the general sewer system, which is on file in this office, although never formally submitted nor acted on by this Department, indicates that there are many criticisms which could be made in regard to the design and construction of these sewers and that much improvement could be made, but as the conditions of needless multiplication of sewer lines has probably arisen through the growth of the institution along lines for which adequate sewers were not designed in the beginning, it would involve a much closer and more extended study of the problem than it was possible to make at this time in order to determine the relative economy of retaining the present system or of designing and constructing a new system.

In regard to the disposal of sewage and fecal wastes from the several buildings on the farms, it was found that conditions in many instances are far from sanitary. At Orchard house, where there were some 30 inmates at the time of the inspection, a two-story privy attached to the building is used. The fecal wastes from the seats on the second floor drop through a shute to a large water-tight box which also receives the wastes from the seats on the first floor. A swing door makes it possible to remove the box for emptying and the inspector was informed that this is done twice a week and the box is cleaned, the fecal matter being spread on land. It was also found that garbage, such as coffee grounds and egg shells, which cannot be fed to hogs, is also thrown into the privy box. The privy is not screened. The sewer, receiving wastes from the kitchen sink, bath tub and wash basins, discharges into a nearby creek which is said to be dry in the summer. The sewer outlet which, it was asserted, was put in some 25 to 30 years ago, has been moved three times, above and below a highway bridge near which it discharges.

At Morningside, where there are some 40 parole patients, both inside flush closets and a privy, which is separate from the building, but connected by corridors, is used. The sewage discharges through a sewer laid to a large cesspool located in a field about 150 feet from the house. The cesspool is covered with plank. At Plymouth Rock, where there are some 29 paroled patients, an outside privy of the two-story type above described is used, the fecal matter being removed once a week and used on the farm. The sewage, consisting of wastes from sinks and bath tubs, discharges into a small stream which is said to be dry in summer.

Flush closets which could not be inspected at the time of this investigation have been installed at Pine Camp and the sewage is said to be discharged into a cesspool located in the field below the camp. The inspector was informed that this cesspool has a system of radiating tile pipe which allows the overflow to percolate into the soil, but that trouble has been experienced with it and that it is to be improved. There is danger at this point, not only of polluting the water supply of the camp, part of which is taken from the river up-stream from this point, but there is also danger of polluting the water supply of the main buildings which is taken from the Susquehanna river about a mile below this point and on the same side of the river. At the Parkhurst building there is maintained a privy detached from the main building and having a dug vault, stoned up, which is cleaned every spring. The privy is not screened. The sewage from the lavatories, bath tub and kitchen sink is discharged into a cesspool which is emptied by means of pails.

A general survey of the means of disposing of the sewage and fecal wastes from the farms shows that the means employed are obviously a constant source of danger to the separate communities. Although every effort may be made to maintain the several privies in a sanitary condition, yet it will be seen that the nature of their construction is such as to make this very difficult and they cannot help but be a continued source of trouble. The sewage of the several places is also not properly disposed of, since the discharge of sewage into a dry watercourse has, in one instance, given rise to a nuisance and is a source of danger to the health of the communities, while it has been pointed out that very serious consequences may arise from an improper disposal of the wastes from Pine Camp. Although the Morningside cesspool is located at some distance from the building, it is near a road and cannot be said to be a satisfactory means of sewage disposal, because it has been shown by experience that, due to the considerable amounts of grease in institutional wastes, cesspools will eventually clog up, even in very porous soil.

At Parkhurst the cesspool is emptied by pails, which is a source of trouble, and the suction line of the water supply pump is in the sewage contaminated soil, which is not only polluted by the sewer and cesspool, but also by the privy. This privy is not screened, and as one of the principal herds of cows is kept at this farm and the milking is done in a barn within 75 feet of the privy, no screens being provided at the barn, it is obvious that a dangerous epidemic may result from contamination of the milk through flies.

In connection with the disposal of sewage at the institution, it should be mentioned that the power house and filter house, which are part of the same building, standing as it does on the river bank, are below the sewerage system, the main outfall of which passes along the bank above it. It was originally intended to dispose of the sewage from the flush closets in the building by discharging it into a cesspool in front of the building and the flush closets and other fixtures were accordingly installed but subsequent to an inspection it was pointed out by this Department that the location of the cesspool was such as to endanger the purity of the well water supply and it was abandoned. The inspector was informed that the flush closets are not used although garbage has been thrown into them probably by the inmates who are employed about the place. A privy in which the fecal matter may be burned is used. This consists of a long fire box into which the feces is deposited directly, covered with coal dust and burned from time to time. The arrangement is not a satisfactory one because of the difficulty of keeping the place in a sanitary condition. of the open and exposed condition of the contents of the fire box and the difficulty of obtaining and maintaining a heat sufficient to entirely consume the organic matter in an apparatus of this kind.

Garbage disposal

The edible portions of the garbage are fed to hogs and chickens and the remainder is burnt. The garbage is placed in barrels and galvanized iron cans for which covers are evidently provided but not always used. These barrels and cans are placed on concrete platforms provided for that purpose and the platforms are in some instances screened by an arbor of vines. Other refuse is thrown upon a dump located in the southeastern part of the grounds, at the side of a ravine near a road. The dump is about 600 feet from the nearest occupied building. The ravine is drained by a small stream which flows into the Susquehanna river. A fire is kept smoldering on the dump to consume the inflammable material. In general it may be said that the garbage should be kept covered during storage and collection and it would be better if the dump were located at a greater distance from the buildings.

Heating and ventilation

The original source of all the heating of the main group of buildings is steam which is obtained from the power house located on the banks of the Susquehanna river. The steam is carried through mains which pass from building to building supplying the heat for the coils of the indirect system heating fixtures and for the direct system radiators. Steam was noticed

escaping from these pipe lines at different points indicating that they were in need of repair.

In nearly all of the buildings both the direct and indirect systems are used and so far as could be determined by the inspector sufficient heat is provided. But it was found that in one instance in the main building, air is taken from the cellar at a point a considerable distance from any window and where the cellar is damp and not easily kept clean. In the east building it was found that some of the fresh air ducts are located under the porches close to the ground and this location together with the location of the ducts in the area ways is open to the criticism that the air passes over the refuse which collects in such places. In the south building some of the air intakes were broken. The steam coils of the indirect systems are in the newer installations incased in galvanized iron casings but in the older ones the casings are generally of wood, which in many instances is in need of repair.

The heating of the outlying farm houses is by individual plants, the heating system of Morningside being both direct and indirect, while the other buildings are all heated by direct radiators.

Ventilation — Special provision has been made in nearly every case for the ventilation of the buildings, this being accomplished not only by transsoms over the doors of the rooms but by especially arranged air shafts into which openings covered by registers are provided in the several rooms. However, the inspector noticed a number of instances, where through the covering of a ventilator by a wardrobe or other article of furniture the maximum benefit was not being derived from the system. A very serious condition regarding ventilation exists in the overcrowding of many of the wards, resulting in insufficient floor and air space. Some instances of these unsatisfactory conditions are indicated in the table below although it has not been attempted to record all such cases.

WARD	Number of beds	Square feet of floor space	Cubic feet of air space	Remarks
6	5	27	280	
7-4	2	35	345	
Rooms 20 — 1 room dor-	8	40	244	
mitory	12	36	325	
23-3 dormitories	12	33	425	Nineteen patients eat in lavatory.
24-3 rooms	2	45	445	
29	21	42	450	
33	2	28	295	
42, dormitory	57	45	528	
49	55	47	550	
61	14	47	521	
Orchard	....	....	....	
House dormitory	5	48	432	
Plymouth Rock	12	31	278	
Morningside	19	40	355	
Parkhurst	12	34	280	

In general the floor space should not be less than 50 square feet per bed, nor should the air space be less than 600 cubic feet per bed; and for the lower class of patients, such as "bed cases," or where ventilating facilities are not satisfactory, more space should be provided. The table indicates that in some cases the floor space is as low as 27 square feet per bed and the air space as low as 244 cubic feet per bed. In some of the wards the dormitories are also used as day rooms, in which case the minimum space should be greater than the figures given above. In ward 23 it is necessary to feed 19 of the patients in the lavatory, and in many of the wards the halls are used for day rooms. The general condition of overcrowding is also

indicated by the fact that the certified capacity of the institution is 2,110 inmates, and the number of inmates present at the time of the inspection was 2,373, an excess of 263, or approximately 12 per cent. The extra patients are taken care of not only by crowding the dormitories, but also by placing beds in the halls. It is evident from the above that more room is needed at the institution in the way of additional buildings or additions to the present ones to properly care for the present number of patients.

Milk

The milk supply of the institution is derived partially from its own herds of cows and partially by purchase from farmers. The inspector was informed by the steward's office that the average daily production of milk at the institution is 950 quarts and the average daily amount of milk purchased is 530 quarts.

The principal herd of cows is kept at Parkhurst, where there are 91 cows, while the other herd of 47 cows is at Orchard house farm, and the milk is sent to the institution each day after milking. At Parkhurst two marble hand basins are installed in the cow barn, which has a concrete floor, but is not screened. The inspector was informed that the cows' bags are washed before milking; the milkers are not allowed in the milk room while they are milking. The milk pails are washed in hot water in the kitchen of the farm-house.

At Orchard house the conditions in the cow barn were found to be similar to those at Parkhurst except that tin washbowls are installed and the milk room is screened.

Conclusions and recommendations

1. Owing to the unsatisfactory condition of some of the buildings I would recommend that:

   (a) The cellars of the main building and Parkhurst be properly protected from dampness.

   (b) Repairs be made to wards 5, 6 and 26 as noted in this report and the rats in ward 20 be exterminated.

2. That in view of the inadequacy of the plumbing fixtures in many of the wards of the institution,

   (a) Additional fixtures be placed in all cases where needed to provide an adequate number of fixtures for the normal capacity of the ward.

   (b) That the plumbing of south building be overhauled and improvements be made to place the fixtures in proper condition and make them accessible; that the old and deteriorated plumbing be replaced by new and that whenever possible the enclosed plumbing be replaced by open plumbing.

   (c) That modern sanitary plumbing fixtures be installed at all of the outlying farms and camp.

3. That, since the arrangement and condition of the indirect heating system is in some instances unsatisfactory,

   (a) The fresh air for the indirect systems of heating be taken from the outside air at points as far as possible above the ground and at points where the air will not be contaminated.

   (b) The indirect air ducts and the casings of the heaters be kept in repair.

4. In regard to sewerage, that

   (a) Screens should be provided to prevent rags and similar material that is introduced through the fixtures by the inmates from clogging the sewers.

   (b) Whenever practicable steps be taken to improve the condition of the sewers in regard to alignment, grade, facilities for flushing and inspection and adequacy of carrying capacity.

(c) That proper sewerage systems and disposal plants be installed in place of the systems now in use at the outlying farms and camp.

(d) That all privies be discontinued wherever possible.

5. That the garbage be stored and collected in covered resceptacles.

6. That the cow barns be screened and that the manure be removed frequently.

7. In regard to the water supplies:

(a) That the sewers from all of the several farm buildings, including Orchard house, Morningside and Plymouth Rock, be constructed of cast iron pipe with watertight joints in order that all seepage of sewage into the soil may be prevented and the quality of the driven well water supplied at these points be thus safeguarded as far as possible.

(b) That the privies used at these places be discontinued as far as practicable and where this is impracticable that every precaution be taken to prevent any contamination of the soil and ground water from these privies.

(c) That the present source of water supply of Parkhurst be either abandoned and this farm be supplied with water from a source which is not subject to pollution or that the present supply be sterilized before using.

(d) That the supply of water from the Susquehanna river for Pine Camp be abandoned unless the water is purified and that steps be taken to supply this place with pure water for all purposes.

(e) That the reservoir of the water supply system of the main buildings be so improved as to be easily kept clean and free from objectionable deposits.

8. That in view of the overcrowded condition of the institution, causing insufficient air and floor space in many of the wards, additional wards or buildings be provided or the present excess of inmates over the certified capacity be transferred to some other institution.

Respectfully submitted,

THEODORE HORTON,
Chief Engineer

ALBANY, N. Y., *March* 11, 1915

REPORT OF WATER ANALYSIS FOR BINGHAMTON STATE HOSPITAL

Laboratory No.				
Source	Tap, filtered water	Tap, filtered water	Raw Susquehanna river water	Filter effluent
Collected on	2/9/15	2/9/15	2/12/15	2/12/15
Color	Trace	....	....	....
Turbidity	Clear	....	....	....
Odor, cold	1 v.	....	....	....
Odor, hot	1 v.	....	....	....
Solids, total	131	....	....	....
Loss on ignition	37	....	....	....
Mineral residue	94	....	....	....
Ammonia, free	.004	....	....	....
Ammonia, albuminoid	.006	....	....	....
Nitrites	.002	....	....	....
Nitrates	0.40	....	....	....
Oxygen consumed	1.90	....	....	....
Chlorine	16.75	....	....	....
Hardness, total	65.70	....	....	....
Alkalinity	49.00	....	....	....
Bacteria per c.c	50	50	160	*1,700
B. coli type	—	—	+	+

* Not dependable.

Results are expressed in parts per million. + Present. — Absent.

Abbreviations used to describe odors of water: 0, none; 1, very faint; 2, faint; 3, distinct; 4, decided; 5, strong; 6, very strong; a, aromatic; d, disagreeable; e, earthy; f, fishy; g, grassy; m musty; v, vegetable.

REPORT OF WATER ANALYSIS FOR BINGHAMTON STATE HOSPITAL

Laboratory No.				
Source	Tap, filtered water	Well, Orchard House	Park-hurst	Morning-side
Collected on	2/12/15	2/19/15	2/19/15	2/19/15
Bacteria per c.c	300	*66,500	*42,000	*5,600
B. coli type	—	+	+	—

* Not dependable.
Results are expressed in parts per million. + Present. — Absent.
Abbreviations used to describe odors of water: 0, none; 1, very faint; 2, faint; 3, distinct; 4, decided; 5, strong; 6, very strong; a, aromatic; d, disagreeable; e, earthy; f, fishy; g, grassy; m, musty; v, vegetable.

Long Island State Hospital (Brooklyn)

HERMANN M. BIGGS, M.D., *State Commissioner of Health:*

I beg to submit the following report on an investigation of the sanitary condition of the Long Island State Hospital at Brooklyn. This report is based upon an investigation made by Mr. C. M. Baker, assistant engineer, on January 22 and February 10, 1915.

Location and general description

Location — City of Brooklyn, in the Flatbush district.
Certified capacity — 637 inmates.
Present population — Inmates, 833; employes, 177; total, 988.
Area of grounds — Institution proper, 25 acres; Creedmoor farm, 193 acres; total, 218 acres.
Number of occupied buildings. — 12.
Class of inmates — All classes of insane, except the criminal insane.
Site of institution — The institution proper is situated in Brooklyn, in the Flatbush district, just to the east of the Kings County Hospital, and may be reached from New York city by way of the subway to Atlantic avenue, then over Flatbush avenue to Church avenue, and over Church avenue to East Forty-second street. The site of the institution appears satisfactory, but it is only recently that the State has acquired a clear title to it, the institution previously being rented by the State. The hospital also maintains a farm at Creedmoor, on Long Island, about 12 miles from the institution proper. There are about 30 patients at this latter place.

Buildings

General description of buildings — Ten of the occupied buildings mentioned above are located at the institution proper and two at the farm. The buildings include the main group, a part of which is four stories high and in reality comprises seven separate buildings connected by corridors. The central portion is used for administrative purposes and the three buildings on either side have hospital wards. Other buildings are the industrial building, kitchen, laundry, amusement hall and other minor accessory buildings.

The farm was formerly a rifle range, the property of which was recently transferred to the hospital, and the buildings comprise some 16 or 17 wooden structures, only two of which, however, are occupied at present, in addition to a barn.

General physical and sanitary condition of buildings — The buildings at the institution are 50 years old or more and, as stated above, it is only recently that the State has acquired a clear title to the property. Prior to

this time it had been leased. In view of this fact sufficient appropriations have not been allowed for the necessary repairs and maintenance, in consequence of which the buildings are badly run down and much in need of repair. The wall in the hall at the main entrance to the institution was temporarily shored up with timber at the time of the inspection because of the failure of the supporting wall in the basement. The inspector was informed that this condition had existed for about 10 months and that no means were available for making the necessary repairs. In a number of places in the wards the walls and ceilings were much in need of repair and the floors in nearly all places were so badly worn that it is practically impossible to keep them in a sanitary condition. The condition of the dining-room and kitchen, located in the basement, was noticeably unsatisfactory. The floors were worn and insanitary and even the tables in many cases were made of rough boards. One table similarly constructed had been covered with tin which had rusted through in places allowing the filth and dirt to collect under the cover. Three old one-story wooden buildings, the original buildings of the institution constructed over sixty years ago, are used for storehouse, industrial shop and amusement hall respectively. The amusement hall has been repaired to some extent but it is evident that the others have received little or no repair. However, none of these buildings are now in a satisfactory condition for the use being made of them. In fact they are buildings so unsatisfactory in character that they should be removed and replaced by others, modern in type.

Finally it may be stated that the general condition of the buildings at the institution proper is unsatisfactory and, therefore, that they are in need of extensive repair and in some cases the old buildings should be razed and replaced by new ones.

All the occupied buildings at the farm were in a satisfactory condition except the one being used as a barn which is in need of repair.

Water supply

The water used at the institution proper is obtained from the Flatbush water supply of the city, the source of which is driven wells. The farm supply is from the Jamaica Water Works, the source of which is also driven wells. Samples of the water from each of these supplies were taken and sent to the Division of Laboratories and Research for anaylses, the results of which are tabulated below:

Nitrogen as —				Oxygen consumed	Chlorine	Total hardness	Alkalinity	Bacteria	B. Coli		
Free ammonia	Albuminoid ammonia	Nitrites	Nitrates						10 c.c.	1 c.c.	1-10 cc.
FLATBUSH SUPPLY											
.008	.006	.001	4.00	1.00	15.00	75.70	74.00	20	—	—	—
JAMAICA SUPPLY											
.026	.008	.001	4.00	.000	9.50	48.60	10.00	5	—	—	—

The results of these anaylses show comparatively low nitrogen content except that the nitrates are high. High nitrates usually indicate past pollution but if this is true in this case the low bacterial content and the fact that the B. coli type were not present indicate that the process of purification has been quite complete, and that, at the time the sample was taken pollution was not active. Insufficient information is at hand regarding the conditions surrounding the sources of these supplies to determine the possibility or character of any pollution which might exist. However, since the water

is a part of the Brooklyn supply and controlled by the board of water supply, gas and electricity of New York City, the water, is doubtless, maintained in a satisfactory condition. The water consumption at the institution proper is approximately 150,000 gallons daily.

Plumbing

The plumbing is of the open type except in the central portion of the main building where the piping is enclosed in the walls and floors. Much of the plumbing is about fifty years old and since repairs have not been sufficiently made some of the piping is weak and in an insanitary condition. Some lead pipe is still in use and there is considerable light weight cast iron pipe. The inspector was informed by the plumber at the institution that the steam pipes for heating were so deteriorated that they would crush from the pressure of the wrench when attempting to uncouple them. In one case a vent pipe from plumbing fixtures discharges in a brick ventilating flue. A part of the plumbing of the central portion of the main building drains into the storm water sewer. "Saddle connections" are used in many cases in connecting with the old plumbing. It is thus evident that the piping is in need of a general overhauling and that sufficient repairs and changes should be made to put it in a satisfactory condition.

The plumbing fixtures have been recently renewed and were found satisfactory in all cases except that in some instances they appeared somewhat inadequate in number for the patients accommodated. This condition, however, was evidently due to the overcrowding of the wards, a matter to be taken up later.

The plumbing at the farm is of recent construction and is found satisfactory in all respects.

Sewerage and sewage disposal

The domestic sewage is collected by sanitary sewers except in the one case mentioned above in the description of the plumbing which condition should be eliminated. The branch sewers are 6 and 8 inches in diameter and discharged into a 8-foot sewer of the Brooklyn system. The grades of the sewers appeared to be sufficient, although stoppages have occurred occasionally from refuse flushed into the sewers by the patients. No catch basins nor screens are provided to prevent rags and similar material flushed into the sewers by the patients from reaching the main system and although it appears that the system is operating quite satisfactory in general, it is possible that some similar device would eliminate the occasional clogging. Manholes are not suitably located. In some cases there are none at the junction of the branches and an insufficient number are located on the main lines for satisfactory inspection.

Garbage disposal

A portion of the kitchen garbage is collected in covered galvanized cans and conveyed to the Creedmoor farm where it is fed to pigs. Refuse and other similar garbage is cared for by the city. The method of disposal appeared to be satisfactory.

Heating and ventilation

Heating — The buildings are heated by steam from a central plant. As pointed out above the pipes are weak and in need of repair. The inspector was also informed that, with the present system, it is difficult to control the heating, some parts of the institution being over heated, while in other portions the heating was insufficient. It is apparent that the heating system is in need of a general overhauling and repairs.

Ventilation — No forced ventilation is provided in the hospital. Natural ventilation from the windows being depended upon to furnish fresh air in the wards. The certified capacity of the institution is 637 and the population at the time of the inspection was 833, an excess of 196 or nearly 31 per cent. This fact, in itself, indicates to some extent an overcrowding in the wards. The condition, however, being much worse in some of the wards than in others, probably due to the fact that it is impossible to overcrowd the more disturbed patients to the same extent that those of the better class can be overcrowded. The insufficiency of floor and air space in some of the wards is indicated by the following table.

WARD	Number of beds	Square feet floor space per bed	Cubic feet air space per bed	Remarks
Dormitory in ward 4	2	42	503	
Dormitory in ward 4	12	40	480	
Dormitory in ward 5	8	39	467	
Dormitory in ward 5	12	40	480	
Dormitory in ward 6	6	29	348	
Dormitory in ward 6	10	44	527	Sick — bed patients.
Dormitory in ward 8	13	37	443	
Dormitory in ward 9	6	30	360	

In considering this table it should be borne in mind that not less than 50 square feet of floor space and 600 cubic feet of air space should be allowed in all dormitories; that in dormitories for sick or bed patients and the lower grades or more disturbed patients more space should be allowed accordingly; and that in addition to this space suitable day room space should also be provided. It is objectionable to use one room for both a day room and a dormitory for sleeping. All of the rooms mentioned above have insufficient floor and air space and in one particular case, only about one-half of the required amount is allowed. This table does not list all the wards where such unsatisfactory conditions were found to exist. In fact, it is apparent that very similar conditions exist in nearly every ward in the institution. In order to satisfactorily care for the present number of patients at the institution more ward space must be provided.

Milk supply

Both pasteurized fluid milk and condensed milk obtained from New York dealers are used at the institution. Physical analyses are made by the State Department of Agricultural semimonthly and weekly analyses are made at the institution. Occasional bacterial analyses are also made by outside laboratories. It is apparent that proper precautions are being taken to obtain a satisfactory supply but the milk was found stored in a room at the storehouse which was in a filthy and insanitary condition. There was a very disagreeable musty odor from the room and it evidently had been some time since it had been cleaned. Although the milk cans were covered and the inspector was informed that the covers were not removed until the milk was taken elsewhere, sanitary conditions should, nevertheless, be maintained.

In view of certain insanitary conditions at the Long Island State Hospital, as pointed out in detail in this report, I beg to submit the following conclusions and recommendations regarding sanitary improvements:

Conclusions and recommendations

1. That in view of the dilapidated condition of the buildings, the necessary repairs be made to put them in a satisfactory, sanitary condition and that those which cannot be satisfactorily repaired be abandoned.
2. That in view of the insanitary condition of the plumbing, it be generally overhauled and that

(a) All weak or unsatisfactory piping and connections be eliminated.

(b) Any vent pipes from plumbing fixtures discharging into ventilating flues from any part of the buildings be changed so that they discharge into a suitable main vent stack.

(c) The plumbing in the central section be changed so that all domestic sewage is discharged into the sanitary sewers.

3. That, since it is apparent the heating system is unsatisfactory, it be overhauled and the necessary changes or repairs made to put it in a satisfactory condition.

4. That, in view of the general overcrowding of the wards, thus causing insufficient floor and air space for the number of patients being cared for, more buildings or additions to the present ones be provided to eliminate this unsatisfactory condition or that some of the patients be transferred to other institutions.

5. That sanitary conditions be maintained at all times in all places where milk is stored and that the milk be handled and cared for in the most sanitary manner possible.

Respectfully submitted,

THEODORE HORTON,
Chief Engineer

ALBANY, N. Y., *February* 25, 1915

Buffalo State Hospital (Buffalo)

HERMANN M. BIGGS, M.D., *State Commissioner of Health:*

I beg to submit the following report on an investigation of the sanitary condition of the Buffalo State Hospital at Buffalo. This institution was visited and inspected by Mr. C. M. Baker, assistant engineer in this Department, on March 3, 1915.

Location and general description

Location.— City of Buffalo, county of Erie
Certified capacity.— 1,704
Present population.— Inmates 2,068, employes 218, total 2,286
Class of inmates.—All classes of insane except criminal insane
Area of grounds.— 185 acres
Number of occupied buildings.— 23

Site of institution.—The institution is situated in the northern portion of the city of Buffalo about one mile from the Niagara river. The grounds are bounded on the north by the Scajaquada creek, on the east by Elmwood avenue, on the south by Forest avenue, and on the west by Rees street. The slope of the land is sufficient for good drainage and, in fact, the site of the institution appears to be very desirable, both from a sanitary standpoint and as to convenience and other considerations.

Buildings

General description of buildings.— The main building for inmates is composed of the central or administration building, on either side of which is a wing composed of 5 separate buildings connected by corridors. This group is arranged in the form of the letter "V," the administration building being at the vertex. A kitchen is located at the rear of the building on either side of the center, from which the food is conveyed through the basement on cars to elevators, by means of which it is lifted to the dining rooms in the various wards. Elmwood building, also for inmates, is similarly arranged, but there are only two buildings on each side of the central building. Four other

smaller buildings are also used as wards for the inmates; 6 are used for industrial purposes, 8 for employes' quarters, 1 for an amusement hall and 1 for a power house. In addition to these buildings, which are included in those recorded above as being occupied, there are some 19 others, including barns, sheds and other accessory buildings, making a total of some 42 buildings on the institution grounds. All of the main buildings are constructed either of stone or brick, but the barns and less important ones are wooden structures. The main buildings vary in height from one to four stories.

General physical and sanitary conditions of buildings.— The floors and ceilings in a number of places throughout the buildings were found in an unsatisfactory condition. This was particularly noticeable in the kitchens for the west portion of the main building and Elmwood; also in the toilets throughout the institution. Many of the tiles in the floor of the west kitchen of the main group were broken and at the Elmwood kitchen about one-half of them were missing, leaving only the rough concrete floor. The tile floors in many of the bathrooms were cracked, thus allowing water to leak through and loosen the ceiling plaster in the bathroom below. The construction of the ceiling in these rooms consists of a brick arch laid between steel "I" beams with the plaster directly upon the brick. In many cases the plaster was falling from the ceiling and in one instance a brick had fallen from the arch, thus causing not only insanitary conditions but also danger of actual bodily injury to the patients. The wooden floors in some of the wards were badly worn and in need of repair, although these conditions were not so serious as those mentioned above.

The basements are all well drained and were dry and in a satisfactory condition at the time of the inspection, except in the basement under the cold storage building, in a portion of which water was standing at the time of the inspection. The inspector was informed that moisture in this basement has been the source of considerable trouble in the past, but that means are now available for draining and protecting it from such conditions.

It is evident from the above that repairs are needed in many places throughout the institution, particularly in reference to the floors and ceilings in some of the kitchens and bathrooms.

Water supply

The water supply for the institution is furnished by the city of Buffalo without charge. The Buffalo supply is derived from Lake Erie and is now being treated with liquid chlorine, which is applied by an apparatus installed by the Electro-Bleaching Gas Company. Daily analyses are made of both the raw and treated water. With this treatment of the water and with proper manipulation and control of the plant a satisfactory supply of water should be obtained. The institution is also equipped with three sets of the Electro Water Sterilizing Co.'s apparatus for treating the drinking water of the main building and Elmwood. These, however, do not protect the drinking water supply in the other buildings, and water may also be obtained from the various faucets at the wash bowls and sinks throughout the institution, which are supplied with the untreated water. The apparatus consists of a series of iron plates through which an electric current is passed and over which the water flows, thence the water passes to a coagulating chamber, then through two filters. The theory of the operation is that the iron combines with a portion of the hydrogen in the water setting free nascent oxygen and forming iron hydroxide, the result being sterilization of the water by the nascent oxygen and precipitation of the iron hydroxide in the coagulating chamber which carries down the sediment with it. A control is arranged by means of which the electric current is turned on only when water is being drawn through the filters. Little definite data appeared to be available regarding the efficiency of this method of treatment, but since the installation of the chlorination plant for sterilizing the Buffalo supply this water should be satisfactory without any supplementary treatment.

A sample was taken of the untreated water from a tap at the institution and sent to the Division of Laboratories and Research for analysis, the results being recorded below:

RESULTS OF ANALYSIS OF SAMPLE OF WATER FROM TAP AT BUFFALO STATE HOSPITAL, TAKEN ON MARCH 4, 1915

Nitrogen as —				Oxygen consumed	Chlorine	Total hardness	Alkalinity	Bacteria	B. Coli		
Free ammonia	Albuminoid ammonia	Nitrites	Nitrates						10 c.c.	1 c.c.	1-10 c.c.
.014	.046	.006	0.10	1.10	7.75	114.2	96.0	85	—	—	—

The results of this analysis indicate a water satisfactory in quality at the time the sample was taken, as is shown by the small amount of nitrogenous matter present, the comparatively low bacterial content and the fact that organisms of the B. coli type were not found present in quantities as large as 10 c. c.

Plumbing

The plumbing is of the open type. The main drains are provided with house traps and fresh air inlets and the main soil pipes are carried through the roof with the branches either returned to them or carried to separate vent stacks. The size of the pipes appeared to be adequate and the general condition of the system was satisfactory at the time of the inspection.

The number of plumbing fixtures in several of the wards appeared to be inadequate for the number of patients being cared for. Doubtless, however, this condition is partially due to the overcrowding of the institution, a subject to be discussed later in this report. In general the fixtures appeared to be satisfactorily trapped and back-vented, but in some cases the types of fixtures were unsatisfactory, a number of the old long hopper, wash-down closets still being in use. The general condition of the plumbing fixtures is illustrated by the following table, which, however, does not give a complete list of the unsatisfactory conditions, but simply records a few instances as illustrative of general conditions:

WARD	Number of patients	Toilet Seats		Urinals		Lavatory Bowls		Remarks
		Present number	Required number	Present number	Required number	Present number	Required number	
				MEN'S WARDS				
5	72	4	5	2	2	5	7	
6	71	4	5	2	2	5	7	
9	82	4	6	2	2	5	8	
11	61	4	4	1	2	3	6	Long hopper, wash-down closets.
12	82	4	6	1	2	3	8	Long hopper, wash-down closets.
				WOMEN'S WARDS				
13	53	3	5	......	......	5	5	Long hopper, wash-down closets.
16	75	3	7	......	......	5	7	Long hopper, wash-down closets.
19	79	3	8	......	......	5	8	
20	97	3	10	......	......	6	10	
22	98	3	10	......	......	6	10	

It is apparent from the above table that, in some cases, less than one-half the number of toilet seats that should be provided for the present number of patients on the wards are available. This condition appears to be more pronounced in the women's than in the men's quarters. The old hoppers mentioned above are of the nonsiphon type, in consequence of which paper and fecal matter remain in the trap at the bottom of the hopper, causing, in many cases, disagreeable odors.

In general, for every 100 people 8 toilet seats, 2 urinals, 10 lavatory bowls and 3 shower baths should be provided in the men's wards, and 10 toilet seats, 10 lavatory bowls and 3 shower baths in the women's wards in order to furnish ample toilet and bathing facilities. It is evident therefore that more modern and a greater number of fixtures should be provided in many of the wards throughout the institution.

Sewerage and sewage disposal

Both the domestic sewage and storm water from the main building are collected by a combined system of sewers which discharges into a 15-inch outfall sewer constructed about 40 years ago. Two screen chambers are provided in this outfall sewer, one located just back of the central portion and the other near the southern extremity of the main building. This sewer continues through the city streets until just before entering the Niagara river, where it discharges into one of the city outfall sewers. Considerable trouble has been experienced during the last three years because of the trunk sewer between the two screens breaking, there having been a total of seven breaks during this period, and it is thus apparent that the whole of this section of the sewer is weak and should be renewed. The screens are inspected and cleaned weekly, the screenings being either burned or buried.

A 20-inch sanitary sewer from another portion of the city which passes through the hospital grounds and discharges into the city sewers beyond receives the domestic sewage from Elmwood and a number of the other buildings. The slopes and sizes of the sewers in this system appear to be satisfactory. Manholes are conveniently placed for inspection in the latter system, but in the former an insufficient number are available. Grease traps are placed in the manholes, which receive the sewage from each of the main kitchens.

Garbage disposal

Kitchen garbage is collected in covered galvanized cans and conveyed to the piggery, where it is fed to pigs. Ashes and similar refuse are used for filling in low places and rags are first washed at the laundry and then sold. The method of disposing of the garbage at the institution appeared to be satisfactory.

Heating and ventilation

Heating.— Practically all the heat for the buildings is furnished from steam by the indirect system of radiation, the steam being generated at a central plant. The basements are divided longitudinally by a brick wall into which are built flues that convey the air, heated by the radiator located at the bottom of the flues, to the various rooms in the buildings, the fresh air being obtained directly from outside the buildings except in the case of the easterly wing of the main building. On one side of the wall is a passageway and on the other a space which is entirely separated and contains the radiators, piping, etc., in connection with the heating system. The radiators of the easterly wing of the main building are enclosed in boxes built so that the brick wall forms one side and the ceiling of the basement the top, the bottom being left open. These radiators are old and continually leaking, causing dampness and insanitary conditions within the boxes. In fact, it is apparent that this system should be revised and the radiators renewed. In the other buildings the radiating system is enclosed in a metal drum directly

following the fan which forces the air into the buildings from the outside. This latter heating system appeared to be satisfactory.

Ventilation.— In connection with the latter heating system mentioned above as being satisfactory the pressure system of ventilation is in use; that is, the air is drawn from the outside and forced through heating coils, thence into the wards by fans located in the basements, the air thus being under a slight pressure. But in the other system, that is, in the east wing of the main building, exhaust fans are located in the attic which draw the air from the rooms, thus causing a partial vacuum. In this latter case the fresh air is taken from the basement, which is supplied from outside by open windows. The engineer at the institution informed the inspector that it has been estimated the former system would change the air in the rooms about four times and the latter about two times hourly. This fact has not been verified, but it was nevertheless apparent from the inspection that the former system is much more efficient. It is evident from the above that the facilities for ventilating the buildings are very satisfactory except in the east wing of the main building, where corrections should be made by arranging to draw the air directly from outside the building, and it would also seem advisable to equip this building with the same system provided in the others. This work could very readily be done in connection with the work of revising the present heating system.

A number of wards were considerably overcrowded, as is indicated by the following table showing the floor and air space in some of them. The cases listed in the table illustrate general conditions, and no attempt has been made to record all cases where the conditions are unsatisfactory:

LOCATION	Number of beds	Square feet of floor space per bed	Cubic feet of air space per bed	Remarks
Two dormitories, ward 11	6	40	560	Same in other wards.
Twelve single rooms, ward 12	2	40	560	Typical of others.
Dormitory in ward 16	30	31	434	
Dormitory in ward 19	7	39	496	
Dormitory in ward 19	17	47	658	Used also as day room to some extent.
Dormitory in ward 20	20	40	560	

Not less than 50 square feet of floor space and 600 cubic feet of air space should be allowed per bed in dormitories, in addition to which suitable day room space should also be provided. These figures should, however, be correspondingly increased in wards for sick or uncleanly patients or where the ventilating facilities are inadequate. It is very objectionable in any case to use a room as both a dormitory and day room. None of the dormitories recorded in the table above meet these requirements, since in no case does the floor space per bed exceed 40 square feet except in a ward used also as a day room.

Finally, therefore, it is apparent that improvements are required in the heating system and also in the ventilating facilities in the east wing of the main building and also that more room should be provided to relieve the overcrowding in numerous wards of the institution.

Milk supply

Pasteurized milk obtained from a city dealer is used entirely at the institution. The supply is controlled by the city authorities and is apparently properly cared for after being received at the institution. It is thus evident, as far as could be determined by this inspection, that the milk being supplied to and used by the institution should be satisfactory in quality.

As a result of this investigation, the details of which are recorded in this report, I beg to submit the following conclusions and recommendations:

Conclusions and recommendations

1. That in view of the unsatisfactory condition of the buildings, causing insanitary conditions in certain respects,

(a) The wooden floors in need of repair in the institution, and also the tile floors of the kitchen for the west portion of the main building and Elmwood, be repaired and maintained in a satisfactory condition.

(b) The floors and ceilings of the bathrooms — details regarding the conditions of which are given in the body of this report — be repaired and the necessary improvements made to eliminate the unsatisfactory conditions existing at the time of the inspection.

(c) Suitable drains and protection be provided to prevent moisture in the basement under the cold storage building.

2. That, in regard to plumbing,

(a) The obsolete plumbing fixtures in use at the institution, namely, the long hopper wash-down water closets be removed and modern sanitary fixtures provided instead.

(b) More fixtures be provided in the various wards of the institution in accordance with the requirements indicated above in this report.

3. That, in view of the unsatisfactory condition of the outfall sewer from the main building between the two screen chambers, this portion of the sewer be replaced by one which will satisfactorily meet the needs of the institution.

4. That, since the heating and ventilating facilities are apparently unsatisfactory in the east wing of the main building, these be revised to conform with those of the other buildings or otherwise satisfactorily improved.

5. That to relieve the overcrowded conditions at the institution more room should be provided either by constructing new buildings or additions to the present ones if the present number of patients are to be cared for.

Respectfully submitted,

THEODORE HORTON,
Chief Engineer

ALBANY, N. Y., *March* 10, 1915

Central Islip State Hospital (Central Islip)

HERMANN M. BIGGS, M.D., *State Commissioner of Health:*

I beg to submit the following report on an investigation of the sanitary condition of the Central Islip State Hospital at Central Islip. This institution was inspected by Mr. C. M. Baker, assistant engineer, on August 17, 18, 19 and 20, 1914.

Location and general description

Location.— Central Islip, county of Suffolk
Certified capacity.— 4,017 inmates
Present population.— Inmates 4,955, employes 814, total 5,769
Class of inmates.— Insane persons
Area of grounds.— 1,000 acres
Number of occupied buildings.— 41

Site.— The institution is located at Central Islip, L. I., in the county of Suffolk, about 40 miles from New York city. It is reached from the city by the main branch of the Long Island R. R.. The land owned by the institution adjoins the railroad and extends about 2½ miles to the south. The southern boundary is about three miles north of Great South Bay. The country in the vicinity of the institution is quite level, but in the immediate vicinity of

the buildings the slopes are sufficient to provide satisfactory drainage, except near the southwestern portion of the grounds, where there is a small area of swampy land adjacent to a small creek. The soil is sandy to a depth of about 300 feet.

Buildings and grounds

General description of buildings.— The buildings are arranged in two groups, known as the North and South colonies. The North colony comprises some 21 one-story separate buildings for inmates, in addition to which there are numerous other accessory buildings and quarters for employes, making a total of some 55 buildings in this colony. The buildings are designated under four groups: Groups A, B and C; Groups D, E and F; McGregory Group and Smith Group. Groups A, B and C are one-story wooden structures and comprise the original buildings of the institution completed in 1889. Groups D, E and F are one-story brick structures which were completed in 1895. The other two groups are of comparatively recent construction and are more modern in type. The buildings of the South colony comprise Groups G, H, I and K. They are arranged in the form of a crescent and are connected by corridors. In the rear of Groups G and H and also I and K is located a dining hall and kitchen, which is reached from each of the corresponding groups by a common corridor, thus making it unnecessary for the patients to go out of doors in passing to and from the dining room. The general arrangement of these groups is a central building in which are located offices for the physicians and nurses, with two buildings for patients located on either side. In this colony are also located the tubercular wards, one each for men and women, the quarantine quarters and a power house.

General physical and sanitary condition of buildings.— As stated above, Groups A, B and C are one-story wooden buildings which were constructed in 1880 and Groups D, E and F, one-story brick buildings constructed in 1895. These buildings, although rather old, were found in a fair state of repair, but it appears that the buildings in Groups A, B and C are not entirely adequate for the housing of the class of patients that must be cared for at a hospital for the insane. All the other buildings are of more recent construction and appear to be maintained in a satisfactory sanitary condition, except the quarantine building located back of South colony. This building is only a shack, unfinished inside, provided with no toilet facilities and, in fact, unfit for the use being made of it. A small building nearby for the physicians and nurses is in a similar condition.

In a number of cases the dining rooms and kitchens are not provided with screens, and when they were so provided flies were numerous, indicating that insufficient precautions are taken to eliminate these insects. The tile floor in the main kitchen of North colony was badly broken and in need of repair.

So far as could be learned by the inspector no trouble has been experienced because of moisture in the basements of the buildings and they appeared to be in a sanitary condition at the time of the inspection. Use is made of them only for storage to a very limited extent.

The cow barn is provided with a concrete floor and appears to be sufficient in size, the ventilation being by means of windows. It appeared, however, to be in a very satisfactory condition when inspected. The piggeries are provided with concrete floors and with drains which discharge on the ground nearby. This method of disposing of drainage from the piggeries conforms with the common method of disposing of sewage at the institution, to be described later, and since the piggeries are in an isolated portion of the ground, no trouble has as yet been experienced.

Sanitary condition of grounds.—A portion of the grounds is used for sewage disposal by the method of broad irrigation, as will be described later. However, the grounds in the vicinity of the buildings appear to be in satisfactory condition. Mosquitoes are generally prevalent at the institution, as is common on Long Island, but the fact that there is little or no malaria at the institution would indicate that they are not an appreciable factor in causing disease.

Water supply

There are two separate water supplies, one at each of the North and South colonies. The supply is derived from 24 2-inch driven wells at North colony and 27 3-inch driven wells at South colony. The depth of the wells ranges from 35 to 65 feet, except that at North colony there is one 8-inch well driven to a depth of 840 feet which furnishes the supply of water for the boilers. Water is pumped from the wells directly to the mains. A standpipe with a capacity of 100,000 gallons is provided to store the water at North colony and one of 200,000 gallons at South colony. In addition to this general supply there are, in a few cases, shallow wells located at various places on the grounds. These wells are driven, are provided with a common pitcher pump, and as a rule are improperly protected to prevent contamination from drainage into them. Samples were collected from the main supplies of both North and South colonies, also from one of the wells, and sent to the Division of Laboratories and Research for analysis. The results are recorded in the following table:

NITROGEN AS —				Oxygen consumed	Chlorine	Total hardness	Alkalinity	Bacteria	B. COLI		
Free ammonia	Albuminoid ammonia	Nitrites	Nitrates						10 c. c.	1 c. c.	1-10 c.c.
NORTH COLONY — GENERAL SUPPLY											
.002	.004	.001	1.00	0.20	6.75	36.40	Acid	13	—	—	—
NORTH COLONY-WELL, NEAR WARD M											
....	....	....	....	....	....	....	....	150	—	—	—
SOUTH COLONY — GENERAL SUPPLY											
.004	.004	.001	0.10	0.20	4.38	22.1	Acid	20	—	—	—

The results of the analysis of the sample taken from the general supply of North colony indicate that the ammonia content and nitrites are low but that the nitrates are high. The oxygen consumed is low, the chlorine somewhat above the normal, the hardness and bacterial content low. The B. coli type was not found present. While the high nitrates probably indicate that pollution has found its way into the water to some extent in the past, all other factors indicate that the water at the time the samples were taken was not actively contaminated, or, in other words, that the water has been purified during its passage through the soil. It is impossible to determine definitely the exact source of this pollution, but two possible causes suggest themselves: First, leaky joints in the sewer which passes within about 100 feet of the wells, and second, possible contamination from the method of disposal previously used when the sewage was pumped into a pond covering about one acre in area and allowed to soak into the ground. Insufficient analyses are available to determine whether the pollution is increasing or decreasing. If the source of contamination is an active one, that is, one which is continuing at the present time, the pollution will probably increase, while if the source of the pollution has been eliminated the pollution will decrease, consequently further analyses would give more definite information on this subject.

The analyses of the samples taken from the general supply of the South colony indicate in general the same characteristics as those of the North colony, except that the nitrates are much lower, and it may therefore be concluded that at the time the samples were taken the quality of this water was satisfactory.

The results of the analysis of the sample taken from the shallow well located near Ward "M" show a bacterial content rather high for well water, and the presence of B. coli type in quantities as small as 1 c. c. It is evident that this water is actively contaminated and that the pollution is of a potentially dangerous character. As pointed out above, these shallow wells are improperly protected, and inasmuch as there appears to be no necessity for their use, they should be abandoned.

Plumbing

The plumbing is of the open type, except in some of the older buildings where the piping is enclosed in the floors and walls. Most of the piping is cast iron with lead joints, but in a few cases in the older buildings lead pipe is still in use. The main drains are provided with house traps and fresh air inlets and the main soil pipes are carried through the roof in all cases. No inadequacies were found in the sizes of the pipes. The plumbing in the old buildings dates back for some 25 or 30 years, but it appears that it has been kept in a good state of repair, no leaks or unsatisfactory conditions being noted by the inspector.

In a number of cases the plumbing fixtures were insufficient in number for the patients they accommodated. This condition is partly due, however, to the general overcrowding of the institution. In some of the wards of Group E only one tub and one spray bath, 5 toilets and 8 lavatory bowls are provided for 116 patients, and in one of the wards in G Group one tub, one shower bath, four toilet seats and five lavatory bowls are provided for 100 patients. Although these are pointed out as specific cases of inadequate fixtures, it is not to be inferred that they are the only unsatisfactory ones that exist. One spray bath should be provided for at least every 35 patients and one toilet seat and one lavatory bowl for at least every ten, except that in the men's wards urinals should replace some of the toilets, the final ratio of urinals to toilets being about one to four. Spray baths are preferable to the tub baths, but sufficient tub baths should be available for treating special cases.

Sewerage and sewage disposal

The domestic sewage is collected from the various buildings by sanitary sewers ranging in size from 6 to 12 inches, which conveys the sewage to a disposal plant. Although the grades of these sewers are in general somewhat flat, they are of ample capacity, and flushing is provided by automatic flush tanks in some cases and by systematic hand flushing in others. Manholes provided with perforated covers are suitably located. Storm water is disposed of by underground filtration in the vicinity of the buildings. The sewerage system appears to satisfactorily meet the needs of the institution.

The sewage disposal consists of screening and sedimentation by broad irrigation. The screens for the North colony are composed of one rectangular bar and one round bar screen with openings between the bars approximately three-quarters of an inch. They are provided with suitable overflows. The screens are cleaned twice daily, the screenings being disposed of in trenches, where they are partly burned and the residue buried. From the screen chamber the sewage passes to a sedimentation tank with a capacity sufficient to hold about six hours' flow. The sewage is then pumped through a force main to the irrigation field, where it is discharged through some 40 or 50 hydrants distributed over an area of approximately 63 acres. Assuming the amount of sewage equal to the water consumption, namely, 500,000 gallons daily, the rate of disposal is approximately 8,000 gallons per acre per day. All but four or five, or 1/10 of the hydrants, must be in operation at one time in order to furnish sufficient pipe capacity to dispose of the sewage. The practice at the institution has been to change these hydrants not in operation weekly, that is, to allow a rest period of one week for those hydrants which it is not necessary to use. It is thus evident that a hydrant must be continuously in operation for nine weeks. Undoubtedly more satisfactory results could be obtained if more frequent periods of rest were allowed

for the ground receiving the sewage. It is possible that this could be accomplished by more frequently changing the hydrants in use, or a more satisfactory method would be to provide a greater number of hydrants.

A part of the irrigated area is under cultivation, and the inspector was informed that it had all been cultivated in the spring. The cultivated land in the irrigation area is used for gardening purposes, and sewage was being discharged at the time of the inspection in gardens containing beets, parsnips and cabbages. No provision was made to prevent the sewage coming in direct contact with these vegetables, and so far as could be learned no separation is made of them before being used as food by the inmates. With proper precaution it is possible with comparative safety to raise corn and some other grains which are used as foods on sewage irrigated fields, but the use of vegetables as foods which are raised under such conditions is always attended with considerable danger from infection either through eating them raw, through insufficient cooking or through handling.

The screen chamber at South colony and its operation are the same as for North colony. The sedimentation tank has a capacity sufficient for one-half day's flow when based on 600,000 gallons of sewage daily. The irrigation area for this colony comprises approximately 95 acres, which gives a rate of disposal equivalent to about 6,300 gallons per acre per day. The disposal area at this colony is not cultivated and showed little signs of having been worked recently. However, the inspector was informed that it had been spaded over in the spring. Little evidence of this was available except in the immediate vicinity of the hydrants. No special provision is made in either of the sewage disposals to obtain uniform distribution of the sewage over the land.

The sewage disposal at this institution was made the subject of a special investigation by the Department of Health in 1910 (volume 31, page 490, annual report State Department of Health), at which time practically the same conditions existed as at the time of the recent inspection. The following were the recommendations then made by James H. Fuertes, consulting engineer, employed by the Islip Protective Association to investigate and report on the condition of operation of the sewage disposal works:

"1. Abandon the use of the hydrants in the two lines of distributing pipes nearest to and parallel with Carlton avenue.

"2. Prepare about ten acres of the disposal field for sand filtration by laying out the surface in beds, with embankments between, locating these beds where the character of the soil is most suitable and where the topography lends itself properly to such treatment, in order to provide for proper winter disposal.

"3. Clear the balance of the area of the disposal field, except the portion to be abandoned, by the removal of all brush and vegetation except the trees, which need not be disturbed.

"4. Divide the sewage storage tank at the South colony works into two parts to better facilitate the handling of the sewage and the cleaning of the tanks.

"5 It is my understanding that plans for the necessary works would be prepared by the State Department of Health: if not, then the hospital authorities should have the preparation of the disposal fields and the other alterations suggested carried out from the plans and under the general supervision of an expert in sewage disposal matters.

As to Improvements That May Be Required in the Future

"6. If it be found that the changes and improvements above suggested prove to be insufficient in the future, further additions should be made to the plant so as to secure a nonputrescible effluent to pump in the disposal field. The installation of sprinkling filters would secure this end.

As to the Maintenance and Operation of the Plant

"7. Have the expert who prepares the plans for the suggested changes give proper and detailed written instruction to the superintendent of the hospital as to the proper method of operating the works and give his personal attention to its operation until the employes are sufficiently skilled to manage the works. Allow this expert to keep in touch with the operation of the plant, through the medium of occasional visits, for such time as may be necessary to insure their proper management.

"8. To meet the immediate necessities, the practices with regard to the disposal of scum, sludge and screenings must be changed to avoid any possible contamination of the neighboring streams.

"9. Any available labor should be utilized in clearing out underbrush and weeds, and an effort should be made to get a better distribution of the sewage over the ground than now obtains, pending securing appropriations for the permanent improvement of the works."

A copy of Mr. Fuertes' report was transmitted at that time to the hospital authorities and they were advised to carry out the recommendations made.

It is apparent that only the first of these recommendations, relative to discontinuing the use of certain hydrants, and the eighth, relative to disposing of the screenings and sludge in a more satisfactory manner, have been carried out, and since it is evident that unsatisfactory conditions still exist, the remainder of these recommendations should be complied with. It is possible, however, that due to the increased amount of sewage the ten-acre tract suggested for winter disposal in the second recommendation will be insufficient and therefore that more land should be provided for this purpose.

Garbage disposal

The kitchen garbage is collected daily by garbage cars which deliver it to the piggery, where it is fed to pigs. Covered receptacles are provided at the kitchens for conveying the garbage from the kitchen to the cars, which are in general located close to the kitchens. They were not covered and flies were numerous around them. It would seem that more sanitary conditions could be maintained if screens or some similar covers were provided for these cars, at least during the summer months. Other garbage is disposed of by burning in trenches and burying the residue on a portion of the land included in the area used for sewage disposal.

A bone mill is located near the garbage disposal and, at the time of the inspection, there was a large pile of bones lying outside with no protection except that some lime had been sprinkled over them. The odor from the putrefying organic matter in this vicinity was very strong and flies were numerous. Undoubtedly more sanitary conditions could be maintained at this place if more lime were used and if some protection in the form of screens were provided to prevent flies having direct access to the refuse.

Heating and ventilation

Heating.— Both the direct and indirect systems of heating are in use at the institution. All the older buildings are provided with the direct system, while the newer ones are equipped with both the direct and indirect, the latter system being employed particularly in the toilets and bathrooms. Steam heat is used in all the buildings except a few of the cottages which are provided with hot water. The steam is furnished from two central plants, one located at each the North and South colonies. So far as could be learned the heating facilities of the institution are quite satisfactory.

Ventilation.— Ventilating flues drawing their supply of fresh air from outside the building are provided in most cases. They are heated by steam coils. In general the wards are also well provided with windows for ventilation.

As stated above, the institution is caring for about 23 per cent. more inmates than its certified capacity. Because of this fact many of the wards are much overcrowded, so that insufficient floor and air space are allowed per person. This overcrowding is localized in some of the wards, thus causing conditions even worse than is indicated by the general figures. The condition of overcrowding is brought out in the following table, showing the certified capacity of a number of the wards and the number of patients the ward was accommodating at the time of the inspection, also the corresponding excess:

WARDS EXCEEDINGLY OVERCROWDED

WARD	Certified capacity	Number in ward when inspected	Excess	Per cent. excess
A-3, North colony	44	64	20	45
D-2, North colony	50	64	14	28
H-1, South colony	85	127	42	49
H-2, South colony	81	103	22	27
H-3, South colony	81	103	22	27
H-4, South colony	85	127	42	49
I-1, South colony	80	118	38	47
I-2, South colony	85	118	33	39

It is seen from this table that some of the wards are caring for nearly 50 per cent. more than their certified capacity. This insanitary condition is further emphasized by the following table, showing the floor and air space per bed in some of the wards of the South colony, where the overcrowded conditions were most apparent:

WARD	Number of beds	Floor space per bed	Air space per bed
		Sq. ft	*Cu. ft.*
Room in G-2	29	39	390
Room in G-1	32	45	450
Room in G-4	23	45	450
Room in H-2	14	43	430
Room in H-2	35	38	380
Corridor H-2 and H-3	61	32	320
Room in H-2	42	34	340
Room in H-1	38	36	360
Room in L-1	34	40	400
Room in I-1	4	36	360

These wards were originally designed on a basis of 50 square feet of floor space and 500 cubic feet of air space per bed. In no case should these figures be reduced; in fact, it is much better practice to allow not less than 600 cubic feet of air space per bed. The above figures may be considered as minimum and ought to be correspondingly increased for the lower grade of patients and for sick wards. The space should also be made dependent upon the general conditions regarding the ventilating facilities, number of windows, etc. It is noticeable both from the latter and the preceding tables that the most unsatisfactory conditions of overcrowding are in Group H. It is possible that this localized overcrowding could be somewhat eliminated by a rearrangement of the patients in the wards, although it may be that the class of patients in the other wards will not permit this. This change, however, would not obviate the general condition of overcrowding which is predominant at the institution. It is evident, therefore, that more room is needed to satisfactorily care for the present number of inmates.

The ventilation in the laundry is insufficient, especially in the room for sorting the soiled clothes. The windows are depended upon entirely for ventilation, and owing to the fact that their use is not practicable on account of loss of heat, they do not furnish any adequate supply of fresh air. The air was stale and there was a strong, disagreeable odor from the soiled clothes at the time of the inspection. It is evident that some form of positive ventilation should be provided.

Milk supply

The institution maintains a herd of about 30 cows, from which is furnished the fresh milk that is used. The herd has been tested quite recently and found to be free from tuberculosis. The milk house located at the cow barn is provided with a concrete floor and screens, but at the time of the inspection flies were very numerous in and about it, indicating that insufficient precaution is taken to eliminate these insects from the building. A hot water tank is provided for scalding and washing the cans, pails and other utensils and an aerator is provided for cooling the milk. Aside from the flies the conditions here were found satisfactory. In addition to the fresh milk, condensed milk is used to a large extent. It is delivered in sealed, jacketed, 40-quart cans. The milk is tested weekly at the institution and samples are also sent to the State Department of Agriculture for analysis. It appeared from the inspection that except for the criticism regarding the milk house, mentioned above, satisfactory precautions are taken in obtaining and caring for the milk supply of the institution.

It is apparent from the above that certain insanitary conditions exist at the Central Islip State Hospital, some of which have previously been brought to the attention of the institutional authorities but have not yet been corrected. I therefore beg to submit the following conclusions and recommendations:

Conclusions and recommendations

1. That, in regard to buildings,
   (a) The quarantine quarters be put in a sanitary condition and properly equipped with plumbing, or that new quarters properly constructed and equipped be provided.
   (b) The milk house and all dining rooms and kitchens be equipped with window and door screens, also that proper precautions be taken to eliminate flies from these buildings.
   (c) The floor in the main kitchen be repaired.

2. That, in view of the unsatisfactory condition of some of the shallow wells being used about the grounds of the institution and the apparent pollution of the water in these wells, as indicated by the analysis, they be abandoned.

3. That, in view of insufficient plumbing fixtures in some parts of the institution, as pointed out in the body of this report, better plumbing facilities be provided when needed.

4. That, since the method of sewage disposal appears to be unsatisfactory,
   (a) The recommendations made in 1910 regarding improvements in the method of sewage disposal and previously recorded in this report, which have not been carried out, be complied with as soon as possible.
   (b) That the practice of raising vegetables on the sewage irrigating area be discontinued and that only grain and grasses or similar products from which there is no danger of infection be substituted on such areas.

5. That more sanitary conditions be maintained at the bone mill by using more lime on the raw bones and protecting them from flies by screens or other suitable enclosures.

6. That, in view of the overcrowded condition of many of the wards, more room be provided either by constructing additions to the present building or by erecting new ones.

7. That in view of unsatisfactory ventilation in the laundry, better ventilating facilities be provided, especially in the room used for sorting the soiled clothes.

Respectfully submitted,

THEODORE HORTON,
Chief Engineer

ALBANY, N. Y., *February* 8, 1915

Gowanda State Hospital (Collins)

HERMANN M. BIGGS, M.D., *State Commissioner of Health:*

I beg to submit the following report on an investigation of the sanitary conditions of the Gowanda State Homeopathic Hospital made at your direction by Mr. C. A. Holmquist, assistant engineer of the Department, on February 10 and 11, 1915:

Location and general description

Location.— Town of Collins, Erie county
Certified capacity.— 978
Present population.— Inmates 1,128, attendants 216, total 1,604
Class of inmates.— Insane
Area of grounds.— 500 acres
Number of occupied buildings.— 12

Site of institution.— The institution is located on the Salamanca division of the Erie railroad, about two miles north of the village of Gowanda. Clear creek, a tributary of Cattaraugus creek, flows through the northeastern portion of the property. Cattaraugus creek is about 1½ miles west of the hospital. The main group of buildings of the hospital is situated on rather high ground, forming a divide between these two streams. The drainage consequently appears to be satisfactory. The portion of the property under cultivation, however, is located on a flat table land between the main group of buildings and Clear creek. Although there are no swamps or sluggish streams near the institution, mosquitoes of the culex variety are said to be prevalent during the early part of the summer, especially in or near the wooded area of the property west of the main group. It was also learned that the atmosphere is damp and that fogs are prevalent. This was attributed to the close proximity to Lake Erie, which is only some 11 miles from the institution.

Buildings

General description of buildings.— In general the buildings are divided into a main group, a number of isolated buildings near the main group, and a farm group. The main group consists of the administration building containing offices and two wards for men, two buildings for men's wards and two buildings for women's wards, a building for kitchen and main dining rooms and a bakery, all of which are connected by covered corridors and basements. The farm group, located about one-half mile from the main group, comprises the farmhouse for employes and patients, two cow barns, horse stables, piggery, hennery, milk house and sheds. Near the main group are the nurses' home, three pavilions for tubercular patients, industrial buildings, storehouse, amusement hall, power house, laundry and isolation cottage. The superintendent's cottage and the staff house are situated about one-quarter mile south of the main group.

General physical and sanitary conditions of buildings.— The main group, the superintendent's cottage, the staff house, nurses' home, power house, laundry, industrial building and storehouse are all brick buildings. The remainder of the buildings, including the tuberculosis pavilion, farmhouse, isolation cottage, amusement hall, recreation pavilion, sheds and barns are frame structures. The institution was opened in 1898 and is for the most part in a satisfactory state of repair. The main buildings occupied by the patients and employes are well arranged with respect to sunlight. Most of the buildings occupied by patients and employes, with the exception of the tuberculosis pavilions and recreation pavilion, are provided with concrete basements or cellars, which appeared to be dry at the time of the inspection. These basements are used for the most part as passageways and for carrying steam, water, sewer and ventilating pipes. The basement under the main dining room is used as a dining room for working patients and night nurses. In the case of the basement under the west pavilion it was found that during freshets or storms and spring thaws surface water from the outside of the building

flows into this basement along the ramp which carries the service track leading to the laundry. This basement is not provided with floor drains and it is sometimes necessary to bail out the water which collects in it during storms. A gutter should be constructed along the west end of the pavilion to carry off the surface water and to prevent it from flowing into the basement, and floor drains should, if possible, be provided in order that any water which may find its way into the basement may be carried off into the sewers. If the basement is too low to drain into the sewers by gravity, a sump from which the water could be discharged into the sewers by means of a steam or water ejector should be provided.

It was learned that, although the kitchen, serving pantries and hospital wards are screened during the summer, the screening is not effective or adequate, and that owing to the prevalence of flies during the summer an appropriation for additional screens has been asked for. It is important that hospital wards and places where foods are stored, cooked, handled and eaten should be adequately screened.

The stables and barns of the institution appeared to be maintained in general in a sanitary condition. It was stated that the manure from the cow barns is removed twice daily and deposited in an open concrete pit, from which it is removed every day both during the summer and winter. The manure from the horse stables is deposited in a small open pit near the stables. This manure is also removed daily. Owing to the comparatively close proximity to the farmhouse and milk house, the manure pits should be covered or screened.

Water supply

The water supply of the institution is derived mainly from two groups of springs located about 1½ miles apart on opposite sides of the institution. From these springs the water is pumped through a 6 and a 4-inch cast iron force main to an open concrete reservoir 100x150 feet by 8 feet deep, located near the laundry and power house. From the reservoir the water is again pumped into a 110,000-gallon elevated steel tank whose base is 100 feet above the ground.

One of the group of springs called the Collins Springs, which furnishes about one-third of the supply for the institution, is located on a hillside about 150 feet from Clear creek and at an elevation of some 30 feet above this stream. The area containing the springs is about one acre in extent and is surrounded by a tight board fence provided with a gate. The water flows out of the gravel formation in the hillside at some six different points, and at each of these points a wooden tub which is used as a collecting basin has been sunk into the ground. The tops of the tubs are slightly below the surface of the ground and are not adequately protected from surface wash. A pipe extends from each one of these tubs or collecting basins to a concrete collecting trough, from which the water is discharged through two short lengths of 3-inch iron pipe to a covered wooden reservoir 26 feet in diameter and about 8 feet deep. There is also a 4-inch subsurface collecting drain which discharges into this reservoir. This drain is laid with open joints at a depth of from 12 to 24 inches below the surface of the ground of the area containing the springs. A branch of this drain intercepts the drainage from a highway ditch some 200 feet long and extends to an adjacent gravel bed, where the upper end of the drain is exposed and there intercepts the surface water and springs in the gravel pit. This pit, which is used by the institution for obtaining gravel and sand, is located adjacent to one of the main highways leading to the hospital. It is not surrounded by a fence and is subject to incidental, accidental or wilful pollution from both human and animal origin. The springs are also subjected to pollution from surface wash and seepage from cultivated land above them. There are, however, no other permanent sources of pollution.

In order to protect the Collins supply from wilful or accidental pollution, the drain extending from the gravel pit should be removed or the gravel pit abandoned as a source of gravel and surrounded with a fence. The water collected by the ditch near the highway should also be diverted from the collecting reservoir.

From the covered reservoir referred to above the water flows through a submerged outlet into an adjacent suction well, also of wood, 4½ feet in diameter and 12 feet deep, located under a small frame pump house. From this pit the water is pumped by means of an electrically driven triplex pump through about 4,700 feet of 4-inch pipe to the open concrete reservoir near the laundry and power house.

The other group of springs, from which about two-thirds of the water supply of the institution is obtained, is located on the Cattaraugus Indian Reservation about 3,500 feet west of the institution. Two of the springs are located about 35 feet below the top of a steep bank which is some 200 feet high and extends to the flats above Cattaraugus creek. One of the springs is surrounded by a masonry enclosure forming a collecting basin. A number of tile drains, through which the water from the spring flows into the basin, pass through one of the walls. This basin is covered by a wooden roof containing a trap door. The water from the other spring flows out of a 12-foot length of 2-inch iron pipe which has been driven into the side of the hill for a distance of a few feet and discharges into a small open basin, from which it flows into a covered receiving well of a Bacon air lift.

Under ordinary conditions the water from the two springs flows into the receiving basin of this air lift, from which it is discharged through some 3,500 feet of 6-inch cast-iron pipe to the main reservoir of the institution grounds. A second Bacon air lift is located about 100 feet below the top of the tank. The down-take well of this air lift is about 236 feet deep. It was stated that when this well was driven the water rose to the surface and flowed from the casing when a depth of about 96 feet below the surface of the ground was reached. It appears that a stratum of water-bearing gravel about six feet thick was reached at this point and that a perforated section of casing was inserted in the down-take well in order to collect the water from the water-bearing gravel. The piping connecting the deep well with the two upper springs is so arranged that the water from these springs may be discharged into the down-take well of the lower Bacon air lift and deep well, from which it is discharged into the down-take well of the third Bacon air lift located on top of the bank. From this latter air lift it is discharged into the main reservoir through a 6-inch pipe which also connects with the air lift located 35 feet below the top of the bank so that, when the lower deep well is used, the water is raised to the main reservoir in two lifts.

There appeared to be no source of permanent contamination at the so-called Indian Reservation springs. One of the springs, however, is uncovered and is subject to accidental or wilful pollution, and it appears that some of the Indians living in the vicinity use this spring as a source of supply, and there is a well-defined path leading from the top of the bank to the spring. I am of the opinion that, owing to the possibility of contamination of the water from this spring, it should not be used, but should be by-passed around the receiving well of the Bacon air lift and that the area containing the springs and air lifts should be surrounded by a fence.

As noted above, the reservoir into which the water from the springs is discharged is open and is located from 30 to 40 feet from the power house and laundry, where a large number of inmates are employed. I am of the opinion, therefore, that, although the reservoir is surrounded with a high iron picket fence, it should be covered in order to protect it from wilful or accidental pollution. The covering of the reservoir would also tend to prevent the development of algae growths. I believe also that the section of the force mains from the springs which now discharge near the outlet corner of the reservoir should be so relocated as to discharge near the corner of the reservoir diagonally opposite the outlet or suction chamber of the reservoir in order to prevent the stagnation of the water.

There is also a covered spring located in the woods near the recreation pavilion west of the hospital which is used to supply drinking water for the patients in this pavilion. This spring is protected from surface wash by a covered concrete basin which extends above the surface of the ground. An opening has been left in the sides of the basin, through which the water is dipped in pails and carried to the recreation pavilion for women, where it is

used for drinking purposes. An earthern vault privy is located above the spring and about 150 feet away from it.

In order to safeguard this source of supply, the opening in the side of the concrete basin over the spring should be closed and the water from the spring collected from the overflow pipe and not dipped from the spring itself. The privy located above the spring should be moved to a place as far from the spring as practicable, the earth vault should be cleaned and disinfected, and the new privy should be provided with water-tight removable containers or the spring should be abandoned.

The water consumption at the institution for all purposes varies from 250,000 to 300,000 gallons per day, equal to from 178 to 210 gallons per capita per day. It was learned that during certain dry seasons the supply is inadequate for the needs of the institution and that it is only by exercising the strictest economy that there is enough water even for domestic purposes, with little or no reserve for fire protection. For this reason the water from the hydraulic elevators and the circulating or cooling water from the ice machine and air compressors is returned to the main reservoir and discharged into it through two cast iron pipes.

Although it was stated by the chief engineer of the institution that the pipes from the elevators and cooler are constructed with water-tight joints and that discharge lines into these pipes are under pressure so as to preclude infiltration of ground water into them, there is always a possibility of the elevator water becoming polluted through the wilful or accidental contamination of the elevator pistons, and I am of the opinion, therefore, that the water used to operate the elevators should be wasted. This brings up the question as to the adequacy of the present supply to furnish the institution with sufficient water during certain portions of the year if the elevator water, the water from the gravel pit at the Collins spring and the water from one of the springs at the Indian Reservation, which is open to wilful or accidental pollution, were to be wasted. This is, of course, a question which it is impracticable for this Department to determine and one which should be looked into by the institution.

It would appear, however, in view of the desirability of eliminating all possible sources of contamination of the supply, and considering also the present high cost of pumping due to the distance of the springs from the institution and the excessive heads against which the water must be pumped, that it would be in the interest both of economy and safety that the hospital authorities should take steps to secure another source of supply of unquestionable purity either as an entirely new supply or as an auxiliary to the present supply.

The question of obtaining such new or auxiliary supply from one or more wells near the Collins spring, driven to a sufficient depth to reach the main body of ground water in that vicinity or from deep wells nearer the institution, should be given careful consideration by the institution authorities.

Samples of water from the different sources of supply at the institution were collected by the hospital officials on February 18 and shipped to the Division of Laboratories and Research. The results of the analyses of the sample collected from the tap which represents a mixture of the two spring supplies was not consistent with the results obtained from the analyses of the water of the individual spring supplies, and a second set of samples of water from a tap in the hospital and from other points on the water supply system were accordingly collected for analysis by a representative of the Department on March 9. In order to obtain additional data with reference to the water supply a number of containers were again sent to the institution and the samples of water collected were received by the Division of Laboratories and Research on April 21, 1915.

The results of the analyses follow:

RESULTS OF WATER ANALYSES

Abbreviations used to describe odors of water: 0, none; 1, very faint; 2, faint; 3, distinct; 4, decided; 5, strong; 6, very strong; a, aromatic; d, disagreeable; e, earthy; f, fishy; g, grassy; m, musty; v, vegetable

Municipality	County	Source of sample	Date of collection	PHYSICAL				CHEMICAL (PARTS PER MILLION)											BACTERIOLOGICAL			
						ODOR		SOLIDS			NITROGEN AS—						HARDNESS			B. COLI TYPE + = PRESENT — = ABSENT		
				Color	Turbidity	Cold	Hot	Total	Loss on ignition	Mineral residue	Free ammonia	Albuminoid ammonia	Nitrites	Nitrates	Oxygen consumed	Chlorine	Total	Alkalinity	Bacteria per c.c.: gelatin 20°, 48 hours	10 c.c.	1 c.c.	1-10 c.c.
Gowanda	Erie	Inlet to reservoir, from Collins springs	2/18/15	Tr.	Cl.	1 v.	1 v.	287	17	270	.008	.006	Tr.	0.50	1.00	6.25	162.8	150.0	35	0+3—	0+3—	0+3—
Gowanda	Erie	Inlet to reservoir, from Indian reservation springs	2/18/15	Tr.	Cl.	1 v.	1 v.	193	10	183	.032	.012	.006	0.36	1.10	3.00	162.5	160.0	15	0+3—	0+3—	0+3—
Gowanda	Erie	Tap at hospital (mixture of above)	2/18/15	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	7,300	3+0—	3+0—	0+3—
Gowanda	Erie	Spring in grove	2/18/15	Tr.	Tr.	1 v.	1 v.	202	6	196	.012	.012	.001	9.00	1.20	3.50	154.2	152.0	40	1+2—	0+3—	0+3—
Gowanda	Erie	Tap at hospital	3/9/15	Tr.	Cl.	1 v.	1 v.	240	34	206	.004	.002	.002	3.50	0.70	4.50	154.2	147.0	550	0+3—	0+3—	0+3—
Gowanda	Erie	Reservoir at hospital	3/9/15	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	900	0+3—	0+3—	0+3—
Gowanda	Erie	Discharge from main elevators into reservoir	3/9/15	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	500	0+3—	0+3—	0+3—
Gowanda	Erie	Discharge from laundry elevator into reservoir	3/9/15	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	1,100	0+3—	0+3—	0+3—
Gowanda	Erie	Discharge from Collins spgs.	4/21/15	Tr.	Tr.	1 v.	1 v.	310	34	276	.008	.018	.001	6.00	1.10	7.25	180	149.0	8,700	3+0—	0+3—	0+3—
Gowanda	Erie	Inlet from reservation system	4/21/15	Tr.	2	1 v.	1 v.	194	9	185	.006	.012	.020	0.50	2.20	3.00	160	155.0	350	0+3—	0+3—	0+3—
Gowanda	Erie	Tap at hospital	4/21/15	Tr.	Tr.	1 v.	1 v.	237	19	218	.008	.024	.015	2.00	1.50	4.38	148.6	144.0	40	0+3—	0+3—	0+3—
Gowanda	Erie	Reservoir, near north end	4/21/15	Tr.	1	1 v.	1 v.	223	26	197	.012	.012	.020	3.00	2.80	4.50	157.2	145.0	80	0+3—	0+3—	0+3—
Gowanda	Erie	From store-room or main elevators	4/21/15	Tr.	Tr.	1 v.	1 v.	215	15	200	.002	.012	.010	3.00	2.00	4.63	154.2	146.0	30	0+3—	0+3—	0+3—
Gowanda	Erie	From laundry elevator	4/21/15	Tr.	Cl.	1 v.	1 v.	221	18	203	.006	.004	.020	3.00	1.50	4.75	148.6	145.0	130	0+3—	0+3—	0+3—

RESULTS OF WATER ANALYSES—(*Concluded*)

Abbreviations used to describe odors of water: 0, none; 1, very faint; 2, faint; 3, distinct; 4, decided; 5, strong; 6, very strong; a, aromatic, d, disagreeable; e, earthy; f, fishy; g, grassy; m, musty; v, vegetable

Municipality	County	Source of sample	Date of collection	Physical				Chemical (Parts Per Million)											Bacteriological			
						Odor		Solids			Nitrogen as—						Hardness			B. Coli Type (+ = present, — = absent)		
				Color	Turbidity	Cold	Hot	Total	Loss on ignition	Mineral residue	Free ammonia	Albuminoid ammonia	Nitrites	Nitrates	Oxygen consumed	Chlorine	Total	Alkalinity	Bacteria per c.c.; gelatin 20°, 48 hours	10 c.c.	1 c.c.	1-10 c.c.
Gowanda	Erie	*Reservoir at hospital	3/6/11	Tr.	Tr.	1 v.	1 v.	174	24	150	.022	.026	.006	0.20	1.10	2.25	148.6	143.0	30	0+3—	0+3—	0+3—
Gowanda	Erie	*Tap at hospital	5/9/12	5	3	1 v.	1 v.	241	40	201	.004	.018	.002	4.80	1.03	11.25	165.8	135.0	210	1+2—	0+3—	0+3—
Gowanda	Erie	†Spring in grove	9/8/14	Tr.	3	1 v.	1 v.	176	33	143	.004	Tr.	.001	0.50	0.80	2.25	131.4	119.0	......	......	......	......
Gowanda	Erie	†Reservoir at hospital	9/8/14	Tr.	3	1 v.	2 v.	242	51	191	.002	.004	.002	0.02	0.70	4.00	148.6	143.0	......	......	......	......
Gowanda	Erie	†Collins springs	9/8/14	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	4,700	3+0—	3+0—	1+2—
Gowanda	Erie	†Indian reservation springs	9/8/14	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	3,200	2+1—	0+3—	0+3—

* Samples two days in transit. † Samples three days in transit.

The results of the analyses show that the water from the Collins and the Indian Reservation springs is very hard and subject to intermittent pollution. The nitrites and free and albuminoid ammonia values would indicate that the water of these springs contains a moderate amount of undecomposed organic matter. The nitrates values are high and in one case very high, which indicates the oxidation of organic matter or pollution introduced into the water in the past. Except in two of the samples collected this year the low bacterial count and the absence of B. coli would indicate that the water of the springs for the most part is free from active contamination. It appears, therefore, that the results of the analyses confirm the conditions found at the time of the inspection; that although the water should be of a good sanitary quality, inasmuch as there are no permanent sources of pollution present, both the Collins and the reservation springs are subject to intermittent pollution, and that the springs do receive such pollution at times either through accident or wilful means. Although the pollution is probably largely of animal origin, due to passing of teams and the manure of the cultivated fields above the springs, the chances of contamination of human origin are also present. If the opportunities for accidental or wilful pollution of the water at the Collins and Indian Reservation springs were eliminated and the storage reservoir covered as indicated above, the water supply, although hard, would be of a reasonably satisfactory sanitary quality.

The water from the spring in the grove appears to be of similar composition and quality to the water in the two main springs, except that the nitrate values are very high and that bacteria of the B. coli type were found in one of the 10 c. c. dilutions in the sample collected this year. It is probable that these conditions are due both to the location of this spring, which is situated in a grove where there is considerable organic matter present in and on the surface of the ground, and to the location of a privy situated at a higher elevation than and some 150 feet from the spring. I am of the opinion, however, that this spring, if it is properly protected by closing the opening in the side of the concrete structure inclosing it and if the privy is removed, should furnish a water of satisfactory quality.

Plumbing

The plumbing at the institution is for the most part new, of modern open type and in a satisfactory sanitary condition. All main drains are provided with house traps and fresh air inlets and all soil stacks are carried through the roof. The branch soil pipes from the water closets are looped back to the main stack above all fixtures. The slop sinks, floor drains, shower baths and tub drains are back-vented into the main stacks. The lavatories have anti-siphon traps and are not vented. The main stacks from the lavatories are two inches in diameter and are increased to four inches before extending through the roof. The dishwashing sinks at the kitchens and serving pantries are of wood. All other fixtures are of modern enameled-ware types. The water closets are for the most part of the nonlift type. All fixtures are trapped and all bath and toilet rooms, with the exception of the toilet rooms in the laundry, are well lighted and ventilated. The two toilet rooms in the laundry are inadequately ventilated and lighted. The refrigerator drains discharge into trapped sinks, into trapped floor drains or into drip pans.

Common drinking cups are used at the institution. This constitutes a violation of Regulation 3 of Chapter VII of the Sanitary Code established by the Public Health Council, which prohibits the use of common drinking cups in any public place or public institution. It was learned from the superintendent of the hospital that an appropriation for the installation of drinking fountains had been asked for. It is important that the common drinking cup should be done away with and that drinking fountains of a suitable type should be installed throughout the institution, especially in the wards.

In general the number of fixtures connected with the plumbing system in the wards appeared to be inadequate for the present population of the institution. The following table is a list of the wards in which the lack of an adequate number of fixtures of the different types was most pronounced. In

the first column is given the number of the ward, in the second the number of occupants in the ward at the time of the inspection, and in the remaining columns under each type of fixtures is stated the present number of fixtures and the number that should be provided. The comparison between these latter figures shows the inadequacy of the present facilities:

WARD	Number of occupants	Toilet Seats		Urinals		Lavatory Bowls	
		Present number	Required number	Present number	Required number	Present number	Required number
MEN'S WARDS							
5	65	3	5	1	....	4	6
13	77	3	6	1	....	4	7
19	78	3	6	1	....	4	7
9	65	3	5	1-3-foot	....	4	6
17	60	3	5	1-3-foot	....	5	6
WOMEN'S WARDS							
6	75	3	6	....	....	4	7
10	87	3	7	....	....	4	8
14	88	3	7	....	....	4	8
18	47	2	3	....	....	5	5

From this table it will be seen that in some cases the number of fixtures were less than one-half as many as should be provided for the number of patients served. It may be stated, however, that notwithstanding the apparent inadequacy in the number of fixtures, the bath and toilet rooms appeared to be maintained in satisfactory sanitary condition. This is probably due to the fact that the different classes of fixtures are placed in separate well-lighted and ventilated rooms with tile floors, i. e., the water closets in each ward are in one room and the lavatories in another, the bath tubs and sprays in another and the slop sinks in another.

Sewerage and sewage disposal

The sanitary and domestic sewage and the roof water are collected in separate systems of pipes which connect in manholes at points 50 to 150 feet from the main buildings, where they discharge into a 20-inch combined sewer which empties into Cattaraugus creek about 1¼ miles west of the institution. This sewer is said to be adequate as to size and capacity, and manholes with perforated manhole covers are located along the sewer at intervals of from 200 to 500 feet. The plans for this sewer were not approved by this Department. The point of discharge of this creek is isolated and at considerable distance from any buildings. I am of the opinion, however, that steps should be taken by the institution to provide for a separation and treatment of the sewage. Inasmuch as the roof water and sanitary sewage are collected in separate sets of pipes, it will be a comparatively simple and inexpensive operation to separate the storm water from the sewage. The storm water could then be discharged into some watercourse tributary to Clear creek or possibly into the main outfall sewer below the sewage disposal plant, if such plant is constructed near the institution. It appears that, owing to the comparatively large size of Cattaraugus creek, and since no water supply is derived from it below the institution, it will not be necessary to provide for more than a preliminary treatment of the sewage at this time. The treatment works should, however, be constructed so as to permit of installing works for additional treatment in the future should such works become necessary.

Sewage disposal.— Sewage from the farmhouse is at present discharged into a concrete septic tank which is pumped out and discharged on the surface of the ground near the tank whenever it becomes full. This tank is located

about 150 feet from the farmhouse. The present method of disposal is, therefore, very insanitary owing to the close proximity of the tank to the farmhouse and should be discontinued. It was stated by the superintendent of the institution that this tank connected with the farmhouse is to be abandoned and a sewer constructed from the farmhouse to the main outfall sewer within a few weeks. Plans for the proposed sewer should be prepared and submitted to this Department for approval as required by section 14 of the Public Health Law.

The wash water and wastes from the milk house are also discharged into a covered two-compartment settling tank which empties into a covered pit filled with stones. It was stated that this tank was installed about seven years ago and that there has been no overflow from the tank or absorption pit, which appears to be adequate to care for the wash water from the washroom of the milk house.

Privies.—As noted above there is a privy provided with an earthen vault located near the women's recreation pavilion, which is used for the most part during the summer. Although this privy is screened and is well lighted and ventilated, I am of the opinion that it should be moved and provided with water-tight removable receptacles in order to protect the spring located near the privy from contamination. Another privy of similar construction to the above is located about 25 feet from the farmhouse. It is stated that the contents of these privies are removed and buried at regular intervals.

Garbage disposal

All garbage from the tuberculosis pavilion is burned or treated with lime and buried. All other garbage at the institution is deposited in covered galvanized iron cans, dumped into covered garbage wagons and hauled to the piggery once or twice a day, where it is cooked before it is fed to the hogs. Ashes and cinders are used for filling and grading and the rubbish is burned in an incinerator.

Heating and ventilating

The main group of buildings is heated by the indirect system from a central power plant containing three 125 horse-power boilers, three 150 horse-power boilers and one 175 horse-power boiler. This heating plant is said to be adequate for the present needs of the institution. The farmhouse, staff house and superintendent's cottage are heated by the direct system from independent heating plants located in the basements of these buildings.

The main group of buildings is heated and ventilated during the summer on the plenum system. A large fan placed near the fresh air inlet forces the air, which is heated by steam coils in the fresh air ducts, into the rooms and dormitories through the fresh air inlets. Each of the large dormitories and day rooms have a number of fresh air inlets located about eight feet above the floor and an equal number of foul air outlets located near the ceiling and the same number located near the floor. It was stated that the lower foul air outlets are used in the winter and those near the ceiling in the summer. The foul air outlets connect with the galvanized ducts, which in turn connect with louvered ventilators extending through the roofs of the buildings. Each of the small rooms connected with the different wards and day rooms and used by patients is provided with one fresh air inlet and two foul air outlets, one located near the ceiling and the other near the floor, as in the case of the dormitories and day rooms. During the summer the fans near the fresh air inlets are not used, and the rooms and dormitories are ventilated by a natural draft through fresh air inlets and foul air outlets as well as through the windows. The temperature of the wards is maintained at from 68 to 74 degrees in the day rooms, depending upon the class of patients, and from 62 to 68 in the dormitories.

It appears, however, that a serious condition regarding the ventilation exists in the overcrowding of many of the wards, resulting from insufficient

floor and air space. Although no attempt has been made to record all cases where unsatisfactory conditions exist, the following table shows the inadequacy of floor and air space which exists throughout the institution due to the overcrowded conditions of the wards:

WARD	Number of beds	Square feet of floor space per bed	Cubic feet of air space per bed	Remarks
MEN'S WARDS				
Ward 17	5	42.5	475	Ward 17 comprises a number of small dormitories and a day room on second floor of Administration building.
Ward 17	7	41	460	
Ward 17	5	44	492	
Ward 17	14	35	392	
Ward 19	13	39	362	
Ward 19	6	42.5	405	Ward 19 comprises a number of small dormitories on third floor of Administration building, no day room. This is so-called working ward.
Ward 19	5	45	430	
Ward 19	7	37	354	
Ward 19	15	34	325	
Ward 5	32	42	485	
Ward 5	15	33	385	
Ward 13	60	33	382	
Ward 9	63	31.5	364	
Ward 21	35	42	480	Day room and dormitory.
Ward 23	18	48	480	Tb. pavilion.
Farm ward	23	52	365	Six small windows. Room 7 feet high.
Farm ward	12	38	266	Four small windows. Room 7.5 feet high.
WOMEN'S WARD				
Ward 2	12	36	410	
Ward 4	36	40	462	
Ward 20	30	48.5	510	Day and dormitory combined.
Ward 20	10	29.5	340	
Ward 6	42	32	370	
Ward 6	15	33.5	385	
Ward 10	64	31	338	
Ward 14	68	29	337	
Ward 12	34	42	480	
Ward 16	38	37.5	430	

In only six of the wards did the cubic air space per bed exceed 500 cubic feet and in only two cases was there more than 600 cubic feet of air space per bed in the dormitories of the different wards. In connection with most of the larger wards of the institution there are from four to ten single rooms occupied by two patients each. These rooms vary from 8x12 feet by 11½ feet high to 9x12½ feet by 11½ feet high, giving floor space of from 48 to 56 square feet per bed and air space of from 550 to 695 cubic feet. The most serious conditions, however, appeared to exist at the two dormitories for patients in the farm group. These dormitories are located under the roof on the top floor of the farmhouse and have ceilings of from 7 to 7½ feet high. One of the dormitories, having only four small windows, contained 12 beds and provided a floor space of only 36 square feet per bed and an air space of only 286 cubic feet per bed. These dormitories, which are improperly lighted and ventilated, are entirely unsuitable for patients and should be abandoned.

It is evident from the above that more room is needed at the institution in the way of additional buildings or additions to the existing buildings to properly care for the number of patients in the institution at present. A new building, properly heated, lighted and ventilated, should be provided for the patients employed at the farm.

Milk

All of the milk used at the institution is produced at the dairy owned and operated by the hospital. The herd consists of some 80 milch cows, all of which were said to be free from tuberculosis. The barns were found to be in *a sanitary condition* at the time of the inspection. A separate milk house

is maintained, and it was learned that the milk as soon as produced is transferred to the milk house by a separate set of men from those who do the milking. At the milk house the milk is cooled, placed in 80-quart cans and taken to refrigerators, where it is emptied into tall tin cans called coolers.

The milk cans are not sterilized, but simply washed by inmates at the kitchen before they are returned to the milk house, where they are again rinsed, but not sterilized. The milk cans should by all means be sterilized every day, and it would seem that the milk house would be the proper place to sterilize them, inasmuch as this house is already provided with a steam boiler and since there is adequate space available to store the cans after cleaning.

Recommendations

In view of the above, I would make the following recommendations:

1. With respect to the water supply,
   - (a) That, in view of the limited yield and questionable quality of the present supply, an auxiliary or a new supply of unquestioned sanitary quality be obtained and that, until such supply is obtained, the following additions be made:
   - (b) That the spring at the Indian Reservation, which discharges through an iron pipe into a small open basin, be by-passed around the receiving well of the air lift and wasted, and that the area containing the springs and air lifts should be inclosed by a fence.
   - (c) That the surface wash from the highway ditch near the Collins springs be diverted and not admitted to the receiving reservoir.
   - (d) That the tile drain which drains the gravel pit be removed or that the gravel pit be abandoned as a source of supply of gravel and that the gravel pit area be surrounded by a fence in order to better protect the Collins supply from wilful or accidental pollution.
   - (e) That the concrete reservoir near the laundry and power house be covered.
   - (f) That the force mains from the springs be so extended as to discharge near the corner of the reservoir diagonally opposite the outlet.
   - (g) That the water used to operate the elevators at the institution be wasted.
   - (h) That the opening in the side of the concrete structure over the spring in the grove near the hospital be closed and that the water drawn from this spring be collected from the overflow pipe.
   - (i) That the privy near this spring be removed and the privy vault be cleaned and disinfected.
2. With reference to sewerage,
   - (a) That plans for the separation and treatment of the sewage be prepared and submitted to this Department for approval as required by section 14 of the Public Health Law.
   - (b) That plans for the proposed sewer from the farm be submitted for approval.

3. That additional plumbing fixtures be installed where needed in accordance with the standard indicated in the table in the body of this report.

4. That the use of the common drinking cup be abolished as soon as possible.

5. That, in view of the overcrowded conditions at the institution, new buildings or additions to the existing buildings should be provided in order that no ward may have less than 600 cubic feet of air space and not less than 50 square feet of floor space per bed.

6. That all hospital or infirmary wards, kitchens, dining rooms and pantries be effectively screened against flies.

7. That a gutter be constructed along the west end of the west pavilion and that the basement under this pavilion be provided with floor drains or sumps and ejectors to remove water automatically from this basement.
8. That all manure pits be screened or covered.
9. That the milk cans and coolers be sterilized daily.

Respectfully submitted,

THEODORE HORTON,
Chief Engineer

ALBANY, N. Y., *May* 5, 1915

Kings Park State Hospital (Kings Park)

HERMANN M. BIGGS, M.D., *State Commissioner of Health:*

I beg to submit the following report on an investigation of the sanitary condition at Kings Park State Hospital at Kings Park, L. I. This institution was visited and inspected by Mr. C. M. Baker, assistant engineer, on February 8, 9 and 10, 1915.

Location and General Description

Location.— Kings Park, Suffolk county, L. I.
Certified capacity.— 3,397
Present population.— Inmates, 4,509; employes, 758; total, 5,267
Area of grounds.— 834 acres
Number of occupied buildings.— 62
Class of inmates.—All classes of insane except the criminal insane.
Site of institution.— The hospital is located at Kings Park, L. I., on the Wading river branch of the Long Island R. R., about 45 miles from the Pennsylvania R. R. station in New York city. The land is somewhat hilly and offers good slopes for satisfactory drainage. The soil is in general sandy. The buildings are located about one mile from the north shore line of Long Island. The location of the institution appears to be satisfactory from a sanitary standpoint and also regarding other considerations.

Buildings

General description of buildings.— The 62 occupied buildings mentioned above include 35 used as wards for patients, 11 as employes' quarters, 8 for industrial purposes, 5 for dining rooms, and also an administration building, amusement hall and laboratory. The buildings are arranged into several different groups, well separated. Some cottages, which are two-story wooden structures about 16 years old and were the original buildings of the institution, are still in use. Other wooden buildings used for wards are the tubercular pavilions and an old laundry which has been remodelled and is now being used as a dormitory for patients. Except for some of the industrial buildings and the laboratory, most of the other occupied buildings are constructed of brick and are two or three stories high. Barns and other minor accessory buildings are also provided.

General physical and sanitary conditions of the buildings.— In general the condition of the newer buildings was found satisfactory, but the same cannot be said of the older ones, especially of the old cottages. There are some 16 of these cottages, accommodating from 30 to 60 patients each. The floors in them are badly worn so that it is impossible to maintain them in a satisfactory sanitary condition. The plaster has fallen from the walls and the ceilings in a number of places and much of it that remains is loose and apt to fall at any time. The ceilings in some of these buildings have been covered with building paper and stayed with 1x2-inch wooden strips to hold the plaster in place and also to provide nailing strips for metal ceilings. However, no means were available for providing the metal for the ceilings and completing the work. The floors in some of the dining roome and kitchens were in need

of repair. The building being used as a laboratory is an old wooden structure and was originally provided as a temporary arrangement some years ago, but as no appropriation has been available for constructing a new laboratory and as there is no other available space at the institution, the present structure is still in use. The floors are in an unsatisfactory condition and, in fact, the arrangement of the interior and the general construction of the building are unsatisfactory for the use being made of it.

The inspector was informed by the authorities at the institution that the majority of the dining room and kitchen doors and windows are provided with screens, but in view of the importance of this matter the necessity of providing window and door screens in all cases for these buildings, and also of taking all precautions possible to eliminate flies from them, should be emphasized.

In view of the above facts it is evident that many of the buildings at the institution, especially the older ones, are in need of extensive repairs.

Water supply

Formerly the water supply was derived from a number of shallow wells, which, however, proved unsatisfactory and have been abandoned. The present water supply is derived from eight 8-inch wells driven to a depth of about 490 feet. The strata through which the wells pass are as follows: Sand, 60 feet; clay and sand, 80 feet; clay, 50 feet; gravel, 10 feet; clay, 120 feet; sand, 50 feet; clay, 100 feet, and the remaining 20 feet a water-bearing gravel strata which furnishes the source of supply. The wells are located in the vicinity of the pump house, and it was apparent that they are satisfactorily protected from the possibility of surface contamination. The water is forced from the well by the air lift system to a sump or sump well of about 80,000 gallons capacity, whence it is pumped into the mains, the surplus from the mains over consumption going to a reservoir of about 3,000,000 gallons capacity. This reservoir is constructed of earth and clay and was originally lined with concrete, but the concrete is broken in many places, in consequence of which the reservoir leaks, wasting, it is estimated, about 75,000 to 100,000 gallons of water daily. In view of this fact it has been found impracticable to use this reservoir to any extent, especially during the summer months, because of the limited supply of water. It is estimated that the wells will furnish approximately 1,500,000 gallons daily, but it is apparent that their capacity is insufficient to meet the demands at certain times when the water consumption is at a maximum. In view of this fact it is quite evident that the reservoir should be repaired so that this storage will be available to equalize the supply. This matter is also of great importance in case of fire. With the present arrangement practically the only storage available is that of the 80,000 gallons in the sump, which would be entirely insufficient in the case of a large fire. The water consumption is estimated at an average of approximately 900,000 gallons daily.

A sample of the water was taken and sent to the Division of Laboratories and Research for analysis, the results of which are included in the following table:

Nitrogen as —				Oxygen consumed	Chlorine	Total hardness	Alkalinity	Bacteria	B. Coli		
Free ammonia	Albuminoid ammonia	Nitrites	Nitrates						10 c.c.	1 c.c.	1-10 c.c.
.002	.002	.001	0.24	1.00	4.25	11.10	6.00	40	—	—	—

As a result of the above analyses of the water, which show a low organic and bacterial content and the absence of the B. coli type in quantities as large as 10 c. c. and also a general study of the character of and the conditions surrounding the wells, it is apparent that they should furnish a water satisfactory in quality.

Plumbing

All plumbing at the institution is of the open type. Part of it is of the Durham system and the rest is cast iron pipe. Some trouble was experienced with the Durham wrought iron pipe system when the old wells were in use because of the pipes rusting out, due probably to the large amount of salt in the water, but places where such conditions were found to exist have been repaired and little trouble has been experienced since the new water supply has been in use. Some of the plumbing in the older buildings is 15 or 16 years old, but apparently has been kept in good repair, and appeared to be in a satisfactory condition when inspected. House traps, fresh air inlets, etc., are provided in all cases.

The principal criticism regarding the plumbing fixtures is that in many cases they are insufficient in number. The general condition in this respect is indicated in the following table. The first column gives the location, the second the number of persons, and under each type of fixture is given the present number and the required or total number that should be provided in each case:

LOCATION	Number of people	Toilet Seats		Urinals		Lavatory Bowls		Remarks
		Present number	Required number	Present number	Required number	Present number	Required number	
MEN'S SECTION								
Mattress shop	50	2	4	1	1	......	5	Sinks with faucets. Automatic flush toilets are out of order.
Ward 12	99	3	8	2	2	4	10	
Ward 26	85	5	6	2	2	6	8	
WOMEN'S SECTION								
Ward 4	84	3	8	......	......	4	8	
Ward 5	61	3	6	......	......	4	6	
Ward 42	185	10	18	......	......	9	18	
Ward 45	185	10	18	......	......	8	18	
Ward 48	120	8	12	......	......	11	12	

Undoubtedly the insufficient number of fixtures, as indicated above, is partly and in some cases entirely due to the overcrowding of the wards, a subject to be discussed later in the report. Under present conditions, however, it is evident that in some cases less than one-half the required number of fixtures are provided. In the men's division not less than 8 toilet seats, 2 urinals and 10 lavatory bowls should be provided for every 100 people, and in the women's division 10 toilet seats and 10 lavatory bowls for 100 people. As indicated above, the toilets in the mattress shop, which were of the automatic flush type, were not operating satisfactorily. No attempt has been made to record all cases where the plumbing fixtures are inadequate, but simply to cite a few instances as illustrative of the general conditions.

The number of baths appeared to be insufficient in some cases, as, for instance, in Ward 4, where there is only one shower bath for 85 people, and in Ward 13, where there is one shower bath for 99 people; also in Group 1, where a congregate bath is provided, and 17 showers furnish bathing facilities for 1,117 people, or an equivalent of one shower for about every 66. Three showers should be provided for every 100 people to furnish ample and satisfactory bathing facilities.

Sewerage and sewage disposal

Separate systems of sewers are provided for the sanitary or domestic sewage and for storm water. The branches of the sanitary sewer system are eight

inches in diameter and the pipes in the storm water system range in size from two to five feet in diameter. Occasional stoppages have occurred in the domestic system, possibly two within the last year, because of rags and similar material flushed into the sewers by the patients. No screen chambers are provided to prevent this material from entering the sewer system. A screen is provided, however, in the outfall sewer to prevent such material from reaching the disposal plant. The grades appeared to be sufficient and the sizes of the pipes adequate.

Plans for various changes and repairs in the sewers have been before this Department for approval. The last set of plans, providing for extensive changes and representing the present conditions of plant, were approved in 1912. (Vol. II, page 485, thirty-third annual report State Department of Health.) The disposal plant, as indicated by the plans and now in operation, consists of Imhoff tanks and sprinkling filters. The total capacity of the two tanks is about 3,700 gallons, thus, assuming the amount of sewage equal to the water consumption of about approximately 900,000 gallons per day, the average detention period of the two tanks is about one hour. Sludge beds are provided for receiving the sludge from the tanks. The area of the sprinkling filter is about one-quarter of an acre, thus giving a rate of filtration of approximately 3,600,000 gallons per acre per day when based on 900,000 gallons of sewage daily, but if based on a sewage flow equivalent to 100 gallons per capita per day the rate of filtration would be approximately 2,000,000 gallons per acre per day.

The inspector was informed that no difficulty had been experienced in the operation of the plant and that the results had been satisfactory. However, at the time of the inspection gas bubbles were rising to a considerable extent on the surface of the sewage in the sedimentation compartments of the tanks. Such a condition should not exist and is probably due to sludge adhering to the bottom of the compartment and digesting, or because the lower or digesting compartment is filled, thus allowing the sludge to accumulate in the upper compartment. The sludge in the lower compartment should at all times be kept below the slot in the bottom of the upper compartment, and if it collects on the bottom of the sedimentation compartment it should be loosened and scraped down by means of the squeegee. With the exception of this one condition it was apparent that the plant was operating satisfactorily. The effluent is discharged into the bay below low tide.

Garbage disposal

The kitchen garbage, bones, meat scraps, etc., are collected daily and taken to a piggery, where a part of it is fed to pigs and the remainder, namely, the meat scraps and bones, is digested by a rendering plant. The ashes and other similar refuse are used to fill in low land. At the time of the inspection the method of garbage disposal appeared satisfactory.

Heating and ventilation

Heating.— The heating at the institution is of both the direct and indirect type. Practically all the heating is done by steam, and so far as could be determined by the inspector the facilities are satisfactory for the needs of the institution.

Ventilation.— In connection with the indirect heating in Group 1 fans are provided to force the air into the rooms. In the other buildings, however, the natural circulation of the air is depended upon for this purpose. Except for the ventilation supplied in connection with the heating system, the windows are depended upon to furnish fresh air in the various buildings. The most

serious condition regarding ventilation is the general overcrowding in the wards. This condition is indicated in some of the wards by the following table, giving the square feet of floor space and the cubic feet of air space per bed:

DORMITORY	Number beds	Square feet floor space	Cubic feet air space	Remarks
Room in Ward 4	2	40	520	Typical of single rooms in number of wards.
Room in Cottage 19	17	31	372	Epileptics.
Room in Cottage 26	14	41	495	Used also as day room.
Room in Ward 41	20	36	432	
Room in Ward 41	32	42	504	
Hall in Ward 41	37	43	516	Used also as day room.
Three rooms in Ward 42	13	34	408	
Room in Ward 51	61	52	728	Sick, bed patients. Women
Room in Ward 53	60	53	742	Sick, bed patients. Women
Room in Ward 55	57	56	784	Sick, bed patients. Men Air foul, very bad odor.

In no case should the floor space at the dormitories be reduced to less than 50 square feet nor the air space to less than 600 cubic feet per bed, and these figures should be correspondingly increased for the lower grades of patients, such as in the sick wards and also where the ventilating facilities are inadequate. In addition to the space in the dormitories not less than 40 square feet of floor space per person should be provided for day rooms, thus making a total floor area in the wards of 90 square feet per person. In the table shown above it is noticeable that the floor space is reduced to 31 square feet and the air space 370 cubic feet per bed in one instance; also in another instance only 43 square feet of floor space is provided per bed in a room used both as a dormitory and day room, a condition which should not exist even where more space is allowed. In other words, it is objectionable to use one room as both a dormitory and day room. Insufficient space is provided in the hospital or sick wards indicated in the above table. No attempt has been made to list above all the unsatisfactory conditions, but simply to cite a few instances illustrative of general conditions.

Assuming 90 square feet of floor space per person in the wards, that is, 50 for dormitory and 40 for day rooms, the following table has been prepared showing the relation between the capacity under such conditions, the certified capacity and the present number of patients. Since practically all the rooms are approximately 12 feet high, the cubic space has not been considered, because with sufficient floor space the air space will also be satisfactory. The first column gives the ward number, the second the estimated capacity, the third the certified capacity, the fourth and fifth the total per cent. excess of the certified capacity over the estimated capacity, and the next three columns give the present population and similar information regarding it:

WARD	Estimated capacity	Certified capacity	Excess		Number of patients	Excess		Remarks
			Total	Per cent		Total	Per cent	
5	54	72	17	34	52	—2	—4	36 single rooms.
26	48	55	7	15	83	35	73	
41	105	126	31	30	188	83	79	
42	113	136	23	20	182	69	61	

This table indicates that some of the wards, although not caring for the full number of patients allowed by the certified capacity, are nevertheless overcrowded. In other wards it is apparent that the certified capacity is higher than should be allowed if proper hygienic conditions are to be maintained.

The dormitory space in Ward 5 is composed of 38 single rooms, each of which contains 80 square feet of floor space and 1,040 cubic feet of air space, an amount more than is required for one bed but insufficient for two. It is thus evident that the real capacity of the ward as now arranged is 38. However, the total space in the ward which would be available if the partitions were removed between a number of these single rooms and they were converted into larger wards would accommodate 54 patients, and the computed capacity given in the table above is upon this basis. While the total number of patients in the ward at the time of the inspection, when compared with the computed capacity in the table, does not indicate overcrowding, nevertheless with the ward arranged as it now is, in single rooms, a number of the rooms which contain two beds are overcrowded.

It is also apparent from the table that there is insufficient room in Wards 26, 41 and 42 for the number of patients for which they are certified. No attempt has been made to investigate in detail all the wards in this respect, but it is quite probable that similar conditions exist in some of the others.

The certified capacity of the hospital is 3,397, but this certification includes Ward 2, with a capacity of 34, and Ward 11, with a capacity of 39, which are now in use for attendants' quarters. Deducting the capacity of these wards, the present capacity of the institution as certified by the medical member of the Hospital Commission is 3,324. The total number of patients at the time of the inspection was 3,950, an excess of 326, or about 19 per cent. over the certified capacity, but as pointed out above it is evident that the certified capacity is for more patients than the institution can satisfactorily accommodate, and therefore that the figure of 19 per cent. excess does not indicate the actual conditions of overcrowding. In any case it is quite evident that more room should be provided in order to satisfactorily and hygienically care for the present number of patients.

Milk supply

A portion of the milk is furnished from the institution herd of about 22 cows. The herd was tested last June, at which time seven of the cattle were condemned and four others were suspicious and held for a later test. The cow barn was found in a very clean and satisfactory condition The air space and ventilating facilities in it appeared to be adequate and the stock appeared well cared for. The milk room is satisfactory in construction, is provided with hot water for sterilizing, and it appears that the facilities are quite adequate. Directly after milking, the milk is taken to the kitchens, where it is placed in the coolers. The inspector was informed that the milk cans are washed at the kitchen and sterilized with hot water. However, it would seem that better conditions could be maintained with respect to the milk supply if a steam sterilizer were provided for sterilizing the milk cans and other utensils at the dairy. With this improvement it would seem that a satisfactory quality of milk could be furnished from the institution dairy.

In addition to the milk furnished by the institution dairy, about 840 gallons of fluid milk and 280 gallons of condensed milk are purchased daily from a New York dealer. The fluid milk is pasteurized. The milk which is obtained from the outside dealer is received at the institution in sealed cans and appears to be satisfactorily handled and cared for.

In view of the conditions at the Kings Park State Hospital as pointed out in detail in this report, and since it is evident that several insanitary conditions exist, I beg to submit the following conclusions and recommendations:

Conclusions and recommendations

1. That, in view of the unsatisfactory condition of some of the buildings, especially the cottages and laboratory, as pointed out in detail in this report, the necessary repairs be made to put them in a satisfactory condition or that new buildings of a modern type be provided.

2. That in respect to water supply the storage reservoir be satisfactorily repaired, or that a new reservoir of suitable construction be provided in order that sufficient and suitable storage may be obtained, both to equalize the pumping and furnish adequate storage for fire protection.

3. That, in view of the inadequacy of the plumbing fixtures,

(a) More fixtures, such as water closets, lavatory bowls and baths, be provided in all places where needed, in accordance with the outline given in this report.

(b) All fixtures in an unsatisfactory condition, or not operating satisfactorily, be repaired or replaced by others of a suitable type.

4. That the sludge be removed from the lower compartments of the settling tanks at frequent and proper intervals in such a manner that the sludge will at all times be at least one foot below the slot, and that the bottom of the settling compartments be scraped when necessary in order to maintain the tank in proper operating condition.

5. That, in view of the overcrowded condition of the hospital, more room should be provided either by additions to the present buildings or by erecting new ones. This can be more economically accomplished by removing the partitions between some of the single rooms in certain of the wards and converting them into larger dormitories, thus making the excess space in the single rooms available.

6. That, regarding the milk supply, it would seem that more sanitary conditions could be maintained if a steam sterilizer were provided at the dairy for sterilizing the milk cans, pails and other utensils, and this should be done as soon as possible.

Respectfully submitted,
THEODORE HORTON,
Chief Engineer

ALBANY, N. Y., *March* 3, 1915

Middletown State Homeopathic Hospital (Middletown)

HERMANN M. BIGGS, M.D., *State Commissioner of Health:*

I beg to submit the following report of an investigation of the sanitary condition of the Middletown State Homeopathic Hospital. The investigation was made on February 15, 16 and 17, 1915, by Mr. C. A. Howland, assistant engineer.

Location and general description

Location.— Middletown, Orange county

Certified capacity.— 1,865 inmates

Present population.— Inmates, 2,011, exclusive of 39 on parole; attendants, 421; total 2,471

Area of grounds.— 541 acres

Number of occupied buildings.— 21

Site of institution.— The main buildings of the institution are located upon elevated ground close to and within the northwestern boundary line of the city of Middletown, and because of their situation on a hill the drainage is generally good. Previously part of the farm lands were flooded from time to time, but a system of ditching is alleviating this condition. In two instances the drainage is still not good. One of these is an inclined entrance to the basement of the main building. Water from outside of the building flows down this pavement into the cellar of the building. The barnyard of the stables and piggery located near the main buildings is poorly drained, and consequently it is difficult to keep it in a reasonably clean condition.

In regard to the site of the separate buildings, it may be said that some of them could be better located in regard to the others. For instance, the stables and piggeries of the main buildings are located across the road from the

nurses' home and within 150 feet of it. The inspector was informed that the odor arising from the manure and piggery is decidedly obnoxious at the nearby buildings. These stables are overcrowded, and consequently are not readily kept clean. These insanitary conditions are recognized at the institution, and probably because of the fact that it was thought desirable to move these stables from their present location, little is expended for their maintenance.

Buildings

General description of buildings.— Of the 21 occupied buidings, 14 are occupied by the patients and 7 are occupied by the employes, including the residences of the different members of the administrative staff. There is also a large number of accessory buildings, including the chapel, power house, laundry, barns and greenhouses.

General physical and sanitary condition of buildings.— The principal buildings are constructed of stone and brick and in the majority of cases have slate roofs, but the interiors are finished in wood, and in the older buildings the joists and floors are all wood and these buildings are therefore only partially fireproof. There are also four frame cottages which are occupied by patients, and the buildings at Comfort farm are also of frame construction, as are the contagious disease building and a number of the residences.

While it may be said that general cleanliness prevailed throughout the buildings, yet a number of instances were found where conditions may be improved. Thus in places the painting should be renewed and in Ashley Hall the painting of the plaster walls should be completed in order that they may be more readily cleaned. The hospital of Ward 5, Ward 30, the toilet section of Wards 4, 17, 23 and 24 are cited as instances where painting is needed. Some of the floors are in need of repair, and this is especially marked in the case of the cement floor of the bakery and the floor of the milk room is cracked. In some instances the wards consist of long corridors, on either side of which are rooms, and these corridors are lighted only from the ends and by the light which comes from the rooms. The corridors are therefore, in many instances, rather dark.

Water supply

The water supply for the group of main buildings is derived from the mains of the city of Middletown. Two 6-inch mains, one from the Monhagen reservoir of the Middletown supply and the other from the Highland reservoir, supply the water. These mains both enter the grounds near the northern corner of the property and are laid approximately parallel. Two meters are located in the rear of the main building. The staff house, first assistant physician's residence and three cottages derive their water supply entirely from the Monhagen reservoir main between the property line and the main meters, and individual meters have been installed at these places. Ashley Hall is supplied entirely from the Highland main, while this main is also the principal supply of the west group, nurses' home, farm cottage and cottage 31. All of the other buildings may be said to receive both.

The Monhagen reservoir gives a low pressure service of about 15 pounds per square inch, and on working days the pressure in the Highland main is also low due to its extensive use for manufacturing, but in the night the reservoir fills sufficiently to raise the pressure to about 60 pounds per square inch. During the day time, therefore, sufficient pressure to supply the taller buildings and provide fire service is obtained by pumping from the Monhagen main to a tank of 15,000 gallons capacity located in the tower of the main building and an auxiliary tank in Pavilion No. 1. A telltale, which can be seen by the fireman and which also rings a bell for high and low water level in the tank, is provided and the pumping regulated accordingly. A Knowles duplex pump of cylinder capacity about 12x18 inches, making about 22 strokes per minute, is used.

At night the pressure in the Highland main is sufficient to serve all of the buildings, and therefore the pump is shut down, a crossover opened and all

however, when the construction was completed that the pump pit was damp, and therefore the work has not been accepted. The use of the kitchen building has been delayed for this reason.

The storm water of the several buildings is discharged principally through a 10-inch and a 12-inch sewer discharging into a brook which flows west of the main building. Some of the storm sewers, however, such as those of Ashley Hall and of the staff house, discharge on the ground.

The present condition of the sewer system has evidently resulted from the growth of the institution without adequate sewers being designed in the beginning. The sewers have evidently been built from time to time and without reference to any comprehensive plan. The clogging of the sewers has made it necessary to install a concrete detritus basin, where a series of spikes are provided to remove the rags, etc., from the sewage. This was made necessary by the complaints of the city authorities, who claim that the sewers of the city were clogged by material coming from the institution.

All of the buildings of the institution are not connected with the sewerage system. The sewage from the gardener's cottage, in which are installed a flush closet, sink and bath tub, discharges under the edge of a steep bank in the rear of the building. Although this point of discharge is removed a considerable distance from any building except the gardener's cottage itself, the manner of sewage disposal cannot be said to be sanitary. There is also danger of polluting a dug well located at the side of the cottage. Although the cottage is provided with the city water, the engineer was informed that the well is used in the summer by inmates working in the vicinity.

The contagious ward, which is a separate building located at a considerable distance from the others, is supplied with the city water, but no flush closets have been installed. A privy is located at the end of a hall. This has two seats and the fecal matter is collected in boxes, which can be removed through a swing door in the side of the building. The sink and bath tub wastes discharge through a tile pipe into a ditch in the rear of the building. The inspector was informed that it is intended to install an incinerator for this building.

At Comfort farm, located about one mile from the main buildings, the farmhouse is being remodelled to receive inmates. At present two privies, open at the back, are used, but as plumbing will probably be installed in the building, it will be necessary to provide some sanitary means of disposing of the sewage.

Garbage

The scraps from the separate wards are removed after each meal and the garbage of the several kitchens is removed twice a day. The garbage is stored between collections in galvanized iron receptacles which are provided with covers. The garbage is, however, collected and transferred in open barrels. Such portions of the garbage as are edible are fed to hogs, while the rest is taken to the dump located about one-half mile from the institution and burned. When there is an excess of garbage over the amount that the hogs will eat the excess is sold to farmers, probably about five barrels of garbage per week being disposed of in this manner.

The refuse of the institution other than the edible portions of the garbage is carted to a dump located on flat land about one-half mile from the institution. A fire is kept smouldering on this dump to consume the inflammable material. The inspector observed that the garbage in the piggeries was contained in barrels which were not covered.

Heating and ventilation

Heating.— The majority of the main buildings are heated from a central plant, i. e., the power house. Both the direct and indirect systems of heating

are used, and so far as could be determined by the inspector sufficient heat is provided. The thermometers in the various wards registered a temperature which would average between 70 degrees and 74 degrees Fahrenheit. It is the common practice, except in one or two of the newer buildings such as the west group, to take the air for the indirect heating system from the basements of the buildings. While the basements are in nearly every instance kept clean, this practice cannot be said to be as satisfactory as the system where fresh air is taken directly from outside the building at a point above the ground and removed from sources of contamination. In one of the buildings the indirect system takes air from a basement in which a dining room is located.

The isolated buildings, such as the cottages, Grinnell, Pierson and the nurses' home (Ward 14), the contagious building, the staff house and several of the farm buildings, have separate heating plants. The inspector visited these and found that as far as could be determined at that time these plants are apparently of sufficient size to adequately heat the buildings in which they are installed. A new brick power house has been built at the institution, but the equipment has not yet been obtained.

Ventilation.— Special provision has been made in many of the buildings for their ventilation, this being accomplished by transoms over the doors of the rooms and by especially arranged air shafts into which openings covered by registers are provided in the several rooms. However, the inspector noticed a number of instances where, through the covering of a ventilator by a wardrobe or other article of furniture, the maximum benefit was not derived from the system. In the cottages Grinnell and Pierson the ventilation of the rooms is dependent on the windows, as is also the case in some of the wards, of which Ward 20, hospital, may be mentioned as an example. In Pavilion 1 old shafts in the wall, which appear to have been formerly used as indirect heating shafts, are now used for ventilation.

The overcrowding of many of the wards, resulting in insufficient floor and air space, affects the condition of ventilation. Some instances of these unsatisfactory conditions are indicated in the table below, although it has not been attempted to record all such cases:

WARD	Number of beds	Square feet of floor space	Cubic feet of air space
20 (hospital)	†16	38	470
23-24	18	47	560
41*	52	48	575
64	13	47	520
35*	52	48	575

* Repeated generally throughout the ten wards of West group.
† Sick.

In general the floor space should not be less than 50 square feet per bed nor the air space less than 600 cubic feet per bed, and for the lower class of patients such as "bed cases," or where ventilating facilities are not satisfactory, more space should be provided. An examination of the above table would indicate that at the time of the inspection no cases were observed where the overcrowding was apparently entirely concentrated, although one hospital ward is listed where only 38 square feet of floor space per bed is available. The data gathered would indicate that the overcrowding is general throughout the institution. The general condition of overcrowding is also indicated by the fact that the certified capacity of the institution is 1,865 inmates, and the number of inmates in the institution at the time of the inspection was 2,011, or an excess of 146, or nearly 8 per cent. The extra patients not only crowd the

dormitories, but in some of the wards beds are placed in the halls. It is evident from the above that more room is needed at the institution in the way of additional buildings or additions to the present ones to properly care for the present number of patients.

Milk supply

The milk for the institution is obtained from the Slawson-Decker Company under a contract for which bids are received every six months. The above company, however, has had the contract for a number of years. The company is required to furnish milk which shall conform to the standard specifications of the State Agricultural Department, which department also analyzes samples of the milk, which are submitted twice a month and also inspects the sources of the milk. The contract calls for 40,000 quarts per month and the daily supply is arranged so as to total this amount. This gives a daily consumption of milk at the institution of about 1,300 quarts.

The milk when received at the institution is run through a clarifier of the centrifugal type to remove the sediment. The inspector was informed that about a cupful of sediment is obtained from the daily milk receipts of about 1,300 quarts. A screened cupboard is placed in the milk room to hold the utensils, but the milk room is not screened, and the inspector was informed that it is not screened in the summer. The institution owns about 37 calves, and it is intended to use these as the nucleus of a herd of milch cows. The calves are kept at present in the stables of Comfort farm. Many improvements, such as screens, better facilities for drainage and cleaning the stables and a milk room, including fixtures, where the milkers can wash and obtain water for washing the udders of the cows, should be provided before milking is done at this place.

Conclusions and recommendations

1. Owing to the unsatisfactory condition of some of the buildings, I would recommend,

(a) That the painting of the walls of Ashley building and of other buildings where the walls have not been properly protected be completed and that the painting be renewed in the wards where necessary.

(b) That repairs be made to prevent the inflow of water into the cellar of the main building.

(c) That adequate stables and barns be constructed and that all buildings of such a nature, including the piggeries, be kept in a clean condition and that the manure be removed frequently.

(d) That the cow barns be screened and that adequate facilities for obtaining cleanliness in the milking and a milk room be provided before extensive milking operations are carried on.

2. In regard to the water supplies, I would recommend

(a) That the use of the wells near the baseball field and the gardener's cottage be discontinued.

(b) That a water supply free from contamination be provided for Comfort farm.

3. In view of the inadequacy of the plumbing fixtures in many of the wards of the institution and of its improper construction,

(a) That additional fixtures be placed in all wards where needed to provide an adequate number of fixtures for the normal capacity of the ward.

(b) That the plumbing, wherever enclosed in the walls, floors or in other locations where it is not readily accessible, be replaced by open plumbing of a modern type whenever repairing or other work offers the opportunity for such changes.

(c) That all fixtures be properly trapped and vented.

4. In regard to sewerage, I would recommend,

(a) That whenever practicable, steps be taken to improve the conditions of the sewers in regard to alignment, grade, facilities for flushing and inspection and adequacy of carrying capacity.

(b) That properly designed and constructed sewage disposal works be built for the contagious building, Comfort farm building and the gardener's cottage.

(c) That all privies be discontinued wherever possible. When necessity requires the use of privies, I would recommend that they be well built and have movable pails for the excreta and that they be screened.

5. That the garbage be collected and stored in covered receptacles and removed daily.

6. That the main barns be screened and that the manure be removed frequently.

7. That wherever practicable the system of taking air for the indirect systems of heating from the cellar be abandoned and the air supply be taken from outside the buildings at points where the air will not be contaminated.

8. That in view of the overcrowded conditions of the institution, causing insufficient air and floor space in many of the wards, additional wards or building be provided or the present excess of inmates over the certified capacity be transferred to some other institution.

Respectfully submitted,

THEODORE HORTON,
Chief Engineer

ALBANY, N. Y., *March* 31, 1915

Manhattan State Hospital (Ward's Island, New York)

HERMANN M. BIGGS, M.D., *State Commissioner of Health:*

I beg to submit the following report on an investigation of the sanitary condition of the Manhattan State Hospital at New York city.

Location and general description

Location.— Ward's Island, city of New York
Certified capacity.— 3,596 inmates
Present population.— Inmates, 4,950; attendants, 822; total, 5,772
Area of grounds.— 245 acres
Number of occupied buildings.— 44
Site of institution.— The institution is situated on Ward's Island, to the northeast of which is Little Hell Gate, to the southeast East river, to the southwest Hell Gate, and to the northwest Harlem river. The institution is reached by ferry from the foot of One Hundred and Sixteenth street.

Buildings

General description of buildings.— Of the 44 occupied buildings, about 20 of them are occupied by the patients and 10 by the employes and officers. The rest include the assembly hall, 2 churches, 7 buildings used for industrial purposes, 3 power plants and 1 general store. In addition to these there are barns, sheds and other accessory buildings.

General physical and sanitary conditions of buildings.— The walls of the buildings occupied by patients are constructed of brick, but the insides are finished in wood, the joists and floors are all wood, and the buildings are therefore only partially fireproof. The majority of the buildings, especially the inside of the wards, are much in need of painting. In many places the paint is entirely worn from the woodwork.

The buildings known as the old branch and the new branch, in the women's division, are old structures and are not well adapted to the use now made of them. They are not provided with cellars or basements and the first floor lies close to the ground. The inspector was informed, and the conditions would indicate, that the wards on the ground floor are more or less damp. In plan the buildings are long and narrow, with single rooms arranged on each side of a central corridor. The only natural light in these corridors is that which comes through the adjoining single rooms, and they are therefore rather dark and poorly ventilated. These corridors are occupied during the day as living or recreation rooms. The floors are badly worn and much in need of repair. The calcimine is falling from the walls in a number of places and the woodwork is much in need of painting.

In the east or men's division similar conditions exist in regard to the walls, floors and painting. In Ward 37 the calcimine was loose in places. The concrete floors in kitchens 4 and 12 were in need of repair. A number of rooms in the basement under Ward 47 are used as quarters for some 31 employes. The inspector was informed by an officer of the institution that these rooms had formerly been occupied by patients, but had been condemned for that purpose and, because of the lack of sufficient quarters for employes, were now being used for that purpose. The basement is damp and is not in a satisfactory condition to be occupied as sleeping quarters.

Water supply

The water is supplied from the mains of New York city through two 12-inch mains. The distributing system is composed of 6-inch mains, except in a few cases where a 4-inch pipe is used. The circuits are completed in most cases, leaving but a few dead ends. Samples of the water were taken and sent to the Division of Laboratories and Research for analysis, but the results have not yet been received. The quality of this water is, however, known to be generally satisfactory.

Plumbing

General type.— Some of the older plumbing, which is about 50 years old, is enclosed in the walls and floors of the buildings, but the inspector was informed that when repairs are needed and made this is changed to the open type. Some lead piping is still in use in the oldest buildings. Aside from this, however, the condition of the piping appeared to be satisfactory, no leaks being found at the time of the inspection.

In general the number of fixtures connected with the plumbing systems in the different buildings appeared to be inadequate for the present population of the institution and were rather obsolete or of unsatisfactory type. The following table gives a list of places where these unsatisfactory conditions were found to exist, although no attempt has been made to record all such cases. In the first column is given the number of the ward, in the second column the number of occupants, and in the remaining columns under each

type of fixture is stated the existing and the required number of fixtures. The comparison between these latter figures shows the inadequacy of the present facilities:

WARD	Number of occupants	Toilet Seats		Urinals		Lavatory Bowls		Remarks
		Present number	Required number	Present number	Required number	Present number	Required number	
WOMEN'S DIVISION								
13	60	3	6	......	......	4	6	Old style hoppers.
18	60	4	6	......	......	4	6	
23 (part)	72	3	7	......	......	2	7	
23 (part)	60	2	6	......	......	3	6	
15	50	2	5	......	......	3	5	
20	50	2	5	......	......	3	5	Old type, unsatisfactory.
12	55	2	5	......	......	1	5	Slop sink also used by patients to wash hands and face.
29	126	3	12	......	......	4	12	
31	69	3	7	......	......	4	7	
MEN'S DIVISION								
35	90	3	7	1	2	5	9	
39	103	3	8	1	2	5	10	
48	92	3	7	1	2	5	9	
46	77	2	6	1	2	5	8	
Tailor shop	25	2	2	0	1	......	......	Old type hoppers.
Paint shop	6	1	1	0	1	......	......	
Bakery*	......	......	......	......	......	......	......	

* No toilet facilities.

From the table it will be seen that in Ward 12 only one lavatory bowl is provided for 55 patients, it being necessary to use the slop sink as a place for the patients to wash. In one case that of Ward 29, only one-quarter the required number of toilet seats are provided and one-third the number of lavatory bowls, and in a number of cases less than one-half the required number are provided. In two cases in the men's division no urinals are provided, and the seats in each were the non-lift type. It is impossible under these conditions to maintain satisfactory sanitary conditions. It is evident from the above that more plumbing fixtures are needed in many places throughout the institution.

Sewerage and sewage disposal

The sewage is collected in most cases by combined systems and discharged into the river in the most convenient places, there being some eight different outlets. The sewers vary in size from 6 to 36 inches. The plans for sewerage were never approved by the Department as required by law, and aside from the location of outlets little information was readily available. The inspector, however, was informed that stoppages have occurred due, it is claimed, to material flushed into the sewers by the patients, there being no catch basins nor screens to intercept this material. In the old sewers manholes are not placed at all junctions, but the newer systems are better equipped in this respect. The outlets are above the water line at low tide but covered at high tide. So far as could be learned no serious trouble has been experienced with the sewer system, and although no plans have been approved by the Department and no knowledge is at hand as to the adequacy of the design, the system apparently meets the needs of the institution at this time so far as collection is concerned. It would seem, however, that screening chambers should at least be provided to obviate the possibility of the sewers becoming clogged by material flushed into them by the patients, and further, that more

sanitary conditions would prevail in the vicinity of the outlets if they discharged under the water at all times. It seems hardly necessary to consider treatment of the sewage at this time, or until the general question of treatment of sewage is taken up by the city.

Garbage disposal

Covered galvanized metal cans are provided at the kitchens for receiving the garbage. The garbage is collected from these twice daily into open carts, by means of which it is conveyed to an incinerator. Ashes and other similar refuse is used for filling low places on the island. In general it would seem that the method of disposal is satisfactory except that covers should be provided for the carts, especially during the summer.

Heating and ventilation

Heating.— Both the direct and indirect systems of heating are used, and so far as could be determined by the inspector the heating facilities are satisfactory, except that in a number of cases where the indirect system is used the fresh air is drawn from the basements instead of from the outside.

Ventilation.—Aside from the fact that in some cases in connection with the indirect system of heating — the fresh air is taken from outside the buildings — no special provision is made for ventilation, the windows being depended upon for this purpose. A very serious condition regarding ventilation exists, however, in the overcrowding of many of the wards, resulting in insufficient floor and air space. Some instances of these unsatisfactory conditions are indicated in the table below, although it has not been attempted to record all such cases:

WARD	Number of beds	Square feet of floor space	Cubic feet of air space	Remarks
WOMEN'S DIVISION				
Room in 17	50	45	540	Bed patients.
Room in 17	27	59	710	No outside windows. No special ventilation.
Room in 23	46	35	385	
Ward 29	126	60	660	Day room and ward, combined
Ward 31	69	32	415	Day room and ward, combined
MEN'S DIVISION				
Room in 35	16	45	385	
Room in 39	13	44	532	
Room in 47	14	41	535	
Room in 48	3	42	545	
Room in 47	4	31	410	
Room in 47	10	35	457	
Room in 51	4	31	410	
Room in 56	3	36	468	

In general the floor space should not be less than 50 sq. ft. per bed, nor should the air space be less than 600 cu. ft. per bed; and for the lower class of patients such as "bed cases," or where ventilating facilities are not satisfactory, more space should be provided. The table indicates that in some cases the floor space is as low as 31 sq. ft. and the air space 410 cu. ft. per bed. In one room occupied by bed patients, the floor and air space is less than

the minimum that should be allowed for the best class of patients. The floor space in ward 31 is only 32 sq. ft. and the air space 415 cu. ft. per bed, and this in view of the fact that the ward is used both as a dormitory and a day room. The general condition of overcrowding is also indicated by the fact that the certified capacity of the institution is 3,596 and the number of inmates present at the time of the inspection was 4,950, an excess of 1,354 or approximately 38 per cent. The maximum number of patients present at any one time during the fiscal year 1914 was 5,013, the minimum 4,736 and the daily average 4,855, thus indicating but little variation from the figures at the time of the inspection. The extra patients are taken care of not only by crowding the dormitories, but also by placing beds in the day rooms. It is evident from the above that more room is needed at the institution, in the way of additional buildings or additions to the present ones to properly care for the present number of patients.

In view of the conditions found to exist at the Manhattan State Hospital, as pointed out in detail above, I beg to submit the following conclusions and recommendations:

Conclusions and recommendations

1. Owing to the unsatisfactory arrangements and conditions of some of the buildings, I would recommend that,

(a) All buildings be repainted where the paint is not in good condition.

(b) That proper drains be provided and other necessary provisions be made to eliminate the dampness from the buildings known as Old Branch and New Branch.

(c) That better provisions be made to admit light and air to the corridors of these buildings, or that other day rooms be provided.

2. That, in view of the inadequacy of the plumbing fixtures in most of the wards of the institution, and to their unsatisfactory type in some cases.

(a) Additional fixtures be provided in all cases where needed, in accordance with the standards indicated in the table given in the body of the report.

(b) All old and obselete fixtures be replaced by modern sanitary ones.

(3) That with reference to sewerage:

(a) Screens should be provided to prevent rags and similar material that is flushed down the closets by the patients, from reaching the sewers.

(b) The outlets be extended so that they discharge under water in all cases.

4. That in view of the very much overcrowded condition of the institution, causing insufficient air and floor space in nearly all the wards, additional wards or buildings be provided or the present excess of inmates over the certified capacity be transferred to some other institution.

Respectfully submitted,

THEODORE HORTON,
Chief Engineer

ALBANY, N. Y., *January* 25, 1915

St. Lawrence State Hospital (Ogdensburg)

HERMANN M. BIGGS, M.D., *State Commissioner of Health:*

I beg to submit the following report on an investigation of the sanitary conditions at the St. Lawrence State Hospital at Ogdensburg. The information on which the present report is based was obtained by Mr. C. M. Baker, assistant engineer, who visited and inspected the institution on February 17 and 18, 1915.

Location and general description

Location.— City of Ogdensburg, County of St. Lawrence
Certified capacity.— 1,778 inmates
Present population.— Inmates 2,031, employes 391, total 2,422
Area of grounds.— 1,015 acres
Number of occupied buildings— 85
Site of institution.— The hospital is located about 3 miles northeast of the city of Ogdensburg on a point of land which extends into the St. Lawrence river. The general contour of the land is such that the drainage is good and, in fact, the institution appears to be quite satisfactorily located, both from a sanitary standpoint and other considerations.

Buildings

General description of buildings.— Some 25 of the 55 occupied buildings mentioned above are used as wards for the patients; 4 as kitchens and dining-rooms; 8 as industrial buildings; 10 as employes' quarters and the others include administration building, chapel, amusement hall, laboratory and power house. In addition to these there are about 32 other accessory buildings, including barns, sheds, etc., making a total of some 87 buildings belonging to the institution. The buildings are arranged in groups, each group containing several wards and also quarters for the attendants and physicians, the buildings being joined by corridors so that any one can be reached from the others without going out-of-doors. This applies principally to the central group, group 3 and the Flower group, which are the largest groups at the institution. The other buildings are more or less isolated and, in fact, are in general, only single buildings.

General physical and sanitary condition of buildings.— All the principal buildings are very substantially constructed of stone. The outer buildings, however, such as the barns, sheds, etc., are wooden structures. The hospital opened December 0, 1890. Thus the oldest of the buildings are about 24 years old. They, however, have been kept in good repair in consequence of which the buildings appeared to be in a satisfactory condition at the time of the inspection.

Water supply

The water for the institution is obtained from the Ogdensburg water supply and is delivered to the institution through a 14-inch main. The branches from this main vary in diameter from 4 to 10 inches. Complete circuits are formed in nearly all cases so that there are practically no dead ends. The pressure for domestic purposes at the institution is about 42 lbs. per square inch and for fire protection about 75 lbs.

The Ogdensburg supply is filtered from the St. Lawrence river through a slow sand filter. The operation and efficiency of this plant was made the subject of a special investigation by this Department in 1912. The report thereon, under date of January 15, 1913, pointed out that the plant was operating satisfactorily as was shown not only from the results of an extended series of

analyses, of both the raw and filtered water, but also by the marked reduction in the number of cases of typhoid fever in the city.

A sample of the water was taken from a tap at the hospital at the time of the inspection and sent to the Division of Laboratories and Research for analyses. The results, together with the results of other available analyses of the city supply for the years 1913 and 1914 are recorded in the following table:

DATE	NITROGEN AS —				Oxygen consumed	Chlorine	Total hardness	Alkalinity	Bacteria	B. COLI		
	Free ammonia	Albuminoid ammonia	Nitrites	Nitrates						10 c. c.	1 c. c.	1-10 c. c.
SAMPLES TAKEN IN CITY												
February 13, 1913.....	.028	.064	.001	0.12	1.50	7.25	85.7	83	10	—	—	—
March 27, 1913.......	.012	.040	Trace	0.12	0.70	7.12	120.0	92	20	—	—	—
May 8, 1913..........	.008	.048	.001	0.12	0.40	7.00	105.8	93	24	—	—	—
June 19, 1913.......	.004	.030	Trace	0.08	1.60	6.75	102.8	91	15	—	—	—
July 24, 1913.	.008	.042	Trace	0.08	0.40	8.00	102.8	93	50	—	—	—
February 24, 1914.....	......	....		......	......	......	......	......	3	—	—	—
February 24, 1914.....	......	......	......	......	......	......	......	......	2	—	—	—
May 14, 1914.........	.002	.044	.001	0.06	1.60	7.75	97.2	91	5	—	—	—
SAMPLES TAKEN AT ST. LAWRENCE STATE HOSPITAL												
May 14, 1914.........	.010	.062	Trace	0.10	1.90	7.75	97.2	95	4	—	—	—
February 19, 1915.....	.014	.038	.002	0.06	2.00	8.75	100.0	96	15	—	—	—

The small amount of nitrogenous matter, the low bacterial content and the absence of the B. coli type in quantities as large as 10 c.c. indicate that the water has been satisfactory in quality when the samples were taken for these analyses and it is evident that if the filtration plant is satisfactorily operated a good quality of water should be obtained.

Plumbing

The plumbing is of the open type. The main soil pipes are provided with house traps and fresh air inlets and are carried through the roofs. However, a number of branch soil and waste pipes are neither returned to the main soil pipe nor carried independently through the roof. The pipes appeared to be adequate in size and in satisfactory condition, no leaks being found at the time of the inspection.

A great many of the plumbing fixtures are of obsolete type and also the traps in many cases are not back vented. About two-thirds of the water closets are of the old long hopper, wash-down type and there are also some of the wash-out type still in use. In the former class of water closets paper and fecal matter are nearly always present in the trap at the bottom of the hopper, in consequence of which odors usually prevail in the vicinity of these fixtures. Many of the traps which are not back vented are of the ball non-siphoned type but in a number of cases ordinary S-traps were in use without being back vented. In general, the number of plumbing fixtures appeared to be quite adequate — except in respect to baths in a few cases — for the certified capacity of the institution, but were somewhat insufficient for the present number of patients. The number of baths are noticeably insufficient in Central Hospital West where in one case, only one shower bath is provided for 90 patients; in the Flower group where, in ward 31, one shower bath accommodates 100 patients and also in wards 26 and 34 where one shower for both

wards provides bathing facilities for 83 patients. Shower baths should be provided at the ratio of approximately three to every hundred people in order to furnish adequate facilities for bathing.

In view of the above it is quite evident that modifications and corrections should be made in the plumbing system and in the type of fixtures in many places throughout the institution.

Sewerage and sewage disposal

A combined system of sewers collects both the domestic sewage and storm water and discharges into the St. Lawrence river without purification. The storm water conduits from the roof are trapped and carried independently to the main sewers. The main sewers vary in size from 8 to 20 inches in diameter. The domestic sewer branches to the buildings are mostly 5 inches in diameter except at Inwood where a 4-inch sewer is used. So far as could be determined by the inspection, the grades of the sewers were satisfactory, but stoppages have occasionally occurred, being caused by rags and other material flushed into the sewers by the patients. A screen chamber is provided at the junction of the domestic branch from Flower group with the main sewer and the domestic branches from a part of the Central group empty into a catch basin which discharges into the main sewer. No such provision is made, however, at the other buildings. A screen chamber is provided at the main outfall sewer just before it discharges into the river. The screens are constructed of iron bars with an open space between the bars of about one inch.

The drainage and sewage from the toilets at the farm buildings empty into a small brook which discharges into the river. The amount of sewage here, however, is apparently small and no trouble has been experienced because of this fact.

It is apparent that no especially insanitary conditions are caused at the institution or at the point of discharge because of no treatment having been provided for sewage from the institution. However, the impropriety of discharging sewage directly into the St. Lawrence river is obvious and, therefore, it would seem advisable for the hospital authorities to consider some method of purification at an early date.

Garbage disposal

The kitchen garbage is collected in covered galvanized cans daily and fed to pigs. Ashes and other similar refuse are used for filling in low lands. Certain other refuse is burned in a ravine back of the barn. The method of garbage disposal appeared to be satisfactory.

Heating and ventilation

Heating.— Steam from the central plant is used for heating a majority of the buildings. However, hot water and hot air are used in a few of the more distant and isolated buildings. The indirect system of radiation is used mostly in the hospital wards, the air being taken from outside the buildings in all cases. It is evident from the information obtained by the inspector that the heating facilities are satisfactory.

Ventilation.— The only provision for ventilation other than the doors and windows is in connection with the indirect system of heating in which the natural circulation of the air through conduits is depended upon to furnish sufficient fresh air in the rooms.

The certified capacity of the institution is 1,776 and the population at the time of the inspection was 2,031, an excess of 255 or 14.4 per cent. This indi-

cates that the institution is somewhat overcrowded, a condition which is also indicated by the following table, showing the floor and air space in some of the wards.

LOCATION	Number of beds	Square feet of floor space	Cubic feet of air space	Remarks
CENTRAL HOSPITAL EAST				
Room in Ward E	28	43	515	
Room in Ward F	3	40	460	
Room in Ward F	5	35	525	
Room in Ward H	15	35	525	
CENTRAL HOSPITAL WEST				
Room in Ward E	2	43	515	Eleven such rooms on ward.
FLOWER GROUP				
Room in Ward 36	5	45	540	
Room in Ward 36	6	42	504	
Room in Ward 36	37	30	360	Patients must climb over foot of beds to get into them.
LETCHWOOD GROUP				
Room in Ward 24 B	53	45	540	Sick. Bed patient.
Room in Ward 21	99	40	600	
FARM COTTAGE				
Room in Ward 50	42	30	350	
Room in Ward 50	31	30	360	

No attempt has been made to list all cases in the above table where unsatisfactory conditions exist, but the above information is given as an illustration of general conditions. The most serious overcrowding is found in wards F and H of the Central Hospital East, ward 36 of the Flower group and in the farm cottage where the floor space is as low as 30 and 35 square feet per bed. Not less than 50 square feet of floor space and 600 cu. feet of air space should be provided in all dormitories and in those for sick or bed cases, the lower grade of patients or where the ventilation is inadequate more space should be provided accordingly. In addition to the dormitory space suitable day room space should also be available as it is very objectionable from a hygienic standpoint to use one room both as a dormitory and a day room.

In view of the above, it is evident that more space should be provided the institution either by additions to the present buildings or by providing new ones in order to satisfactorily care for the present number of patients.

Milk supply

The milk is furnished from the institution herd of about 132 cows. The herd is tested yearly for tuberculosis, the last test being in December, 1914, at which time 8 cows were condemned and killed and 4 cows were found suspicious, one of them having since been killed, but it was found to be in a satisfactory condition, the other three being still held for a retest. The preceding year 2 cows were condemned.

The cow barn is equipped with a concrete floor, satisfactory air space and the ventilation appeared to be fairly adequate. The walls and ceilings are covered with sheet metal. The general condition of the barn appeared to be quite satisfactory except at one end where the steel ceiling was badly rusted in places because of occasional leakage through from the horse barn which is located directly over this portion of the cow barn. Although the horse barn is provided with a concrete floor the inspector was informed that leaks occasionally occur. It would seem that more sanitary conditions could be maintained in the cow barn if the horse stable were removed elsewhere providing

an additional building for it if necessary. Adjoining the cow barn is a room where the white uniforms for milking are kept. An oven is provided for heating and sterilizing them and also for sterilizing other equipment. Lavatory bowls are also provided in this room at which the men are required to wash before milking. A majority of the milking, however, is done by a milking machine. It is necessary to strip the cows by hand and also to milk a few of them in this way, but this milk is kept separate from the other and is heated in kettles at the kitchens before being used.

The milk house is constructed of brick and is conveniently located to the barn. It is equipped with a steam sterilizer for sterilizing the milk cans, pails and other utensils, with an aerator for cooling the milk and also with hot and cold water.

It is evident from the above that the dairy is well equipped and that satisfactory conditions exist in all respects, except in regard to location of the horse barn over the cow barn. Apparently proper precautions are taken in producing and handling the milk supply and if the above conditions were eliminated the dairy would be considered in a very satisfactory condition.

As a result of this investigation of the sanitary condition of the St. Lawrence State Hospital, I beg to submit the following conclusions and recommendations:

Conclusions and recommendations

1. That, in view of the insanitary condition of the plumbing as pointed out in detail in the body of this report,
   (a) Where the waste or soil pipes, or the plumbing fixtures are not back-vented suitable ventilation be provided for them.
   (b) All the old types of water closets now in use, namely, the long hopper wash-down and the wash-out types be removed and others of a modern and sanitary type installed in their places.
   (c) More baths be provided where needed in accordance with the required numbers as indicated above in the report.
2. That, since it is apparent the institution is overcrowded so that it cannot satisfactorily care for the present number of patients more room be provided, either by additions to the present buildings or by providing new ones.
3. That, in view of the insanitary condition caused in the cow barn by leakage through the floor of the horse barn above, suitable space be provided elsewhere for the horses and that no stock be kept in the space over the cow barn.

Respectfully submitted,

THEODORE HORTON,
Chief Engineer

ALBANY, N. Y., *March* 15, 1915

Hudson River State Hospital (Poughkeepsie)

HERMANN M. BIGGS, M. D., *State Commissioner of Health:*

I beg to submit the following report on the sanitary condition of the Hudson River State Hospital at Poughkeepsie:

The investigation on which this report is based was made on August 4, 5 and 6, 1914, by Mr. C. M. Baker, assistant engineer, and was the first general inspection to be made of this institution by the Department.

It is the purpose of this investigation to consider all matters which may either directly or indirectly affect the sanitary conditions at the institution, including the following subjects, location and general description, water supply, sewage and waste disposal, heating and ventilating, vital statistics, communicable diseases, organization and administration.

Location

The Hudson River State Hospital is located about two miles north of the city of Poughkeepsie in the county of Dutchess. It may be reached by trolley from the city. The land fronts the Hudson river and the N. Y. C. and H. R. R. R. passes through the lower portion of the grounds. The topography is rather irregular and rough in places, the elevation varying from sea level at the river to 468 feet above at the highest point. The land owned by the institution extends back about 2¼ miles from the river. It is, however, divided into two irregular portions, the western section being roughly 1¼ miles east and west by ½ mile north and south, and the eastern section ¾ mile east and west by 1¼ north and south. The drainage, in general, is good although there are some stagnant ponds caused by Fallkill creek which flows through the eastern portion of the land.

In the lower part of the grounds near the river the soil is sandy while farther back it is clay. Near the river the subsoil is clay while to the eastern portion of the grounds near the foothills blue clay or hard-pan is encountered.

Character and purpose of institution

The object of the institution is the care and treatment of all classes and ages of insane, except those criminally insane.

Buildings and grounds

There is a total of about 104 buildings, 75 in the western section and 29 in the eastern. The principal buildings of the western group include, Main group, Central group, Edgewood, Inwood, Reception Hospital and Isolation Cottage for the housing of inmates, and various cottages and buildings for officers and employes. Other buildings in this section are the bakery, blacksmith shop, carpenter shop, chapels, coal sheds, barns, storage buildings, ice house, industrial buildings, laundry, library, power house, machine shop and various other minor structures. The western section, which is devoted almost entirely to farming, includes the following buildings, cottages 1 to 8 for the housing of inmates, various cottages and buildings for employes, barn, piggeries and other necessary farm buildings. All the necessary buildings occupied by the inmates are constructed of brick but a great many of the others are wooden structures.

The Main building of the Main group or the administration building is four stories high with basement, Central group, Edgewood and the cottages two stories. Inwood and Reception Cottage three stories. In the basement of Main building is the kitchen, on the first floor the administration offices and seven wards, on the second and third floors eight wards each and dining-rooms and on the fourth floor rooms for nurses and attendants. The dining-rooms and kitchens of the other buildings, used for the housing of inmates, are both located on the first floors. On both the first and second floors of Central group and Reception Hospital are two wards each. Edgewood has three wards on each floor and Inwood four. The third floors of both Inwood and Reception Hospital are used as quarters for nurses or employes. In the cottages for inmates there are two wards on each floor, with the dining-rooms and kitchens located on the first floors.

There is a total of 3,574 acres of land belonging to the institution, which, for the most part is used for farming and agricultural purposes. The grounds near the buildings are pleasantly laid out in lawns, flower gardens and shrubbery, there also being an abundance of trees for shade.

Attendance and mortality statistics

The certified capacity of the institutions is 1,226 men and 1,483 women, a total of 2,709, but as many as 3,168 or 459 more than the certified capacity have been cared for at one time, and at the time of the inspection there were present 1,351 men and 1,777 women, making a total of 3,128 or 819 in

excess of the capacity. These figures indicate to some extent the crowded conditions that must necessarily exist in some of the wards. The average daily population for the years 1910, 1911, 1912 and 1913 have been 2,924, 2,943, 3,054 and 3,152 respectively, thus indicating a gradual increase. The number of employes is about 640, making a total population at the institution of 3,766.

During the last four years the deaths have been as follows: 1910, 270; 1911, 313; 1912, 238; 1913, 256; which correspond to the rate of 92.4, 106.3, 78.0 and 81.8 per 1,000 or an average of 96.6 per 1,000. During this period an average of 18.8 per cent. of the deaths have been due to tuberculosis, 15.8 per cent. to general paresis and about 12 per cent. or 15 per cent. to pneumonia. For comparison the following table is given, showing the death rates in the various State hospitals for the last three years:

STATE HOSPITAL	RATE PER 1,000			
	1911	1912	1913	Average
Binghamton	74	74	87	78
Buffalo	84	62	72	73
Central Islip	105	94	100	100
Gowanda	66	61	58	63
Hudson River	105	77	82	88
Kings Park	93	74	67	78
Long Island	175	236	244	218
Manhattan	114	111	117	114
Middletown	48	55	50	51
Mohansic	....	20	17	19
Rochester	104	86	107	99
St. Lawrence	71	96	76	81
Utica	84	75	98	86
Willard	88	64	72	75
Average (from totals of all hospitals)	92	85	89	89

The death rate at the Hudson River State Hospital is seen to be about the same as the average for all hospitals with 9 having a lower rate and 4 a higher rate.

The institution has in general been quite free from epidemic diseases, except that during 1914, 6 cases of typhoid fever had occurred up to the time of the inspection, August 4. These were probably due to the bad condition of the water supply in the early part of the year, but recent improvements have bettered the conditions then existing. The number of tubercular patients at the institution ranges from 130 to 140.

General sanitary condition of buildings and grounds

The buildings in the western section of the grounds described above were generally in very good condition. They are old structures except the Reception Hospital which is of recent construction.

The eight cottages in the eastern section of the grounds are old buildings and part of them are in a very bad state of repair, while others have been recently repaired and are in fair condition. It is understood, however, that no appropriation or means are available for carrying on these repairs. The objectionable conditions mentioned above were noticed in cottages 3, 4, 5, and 6 where the plaster was off from the walls and ceilings in many places and loose and falling in others. The floors were old and worn through in places and were also rough and slivering, making it very difficult, if not impossible, to keep them in a good sanitary condition. In fact the buildings were generally run down and very much in need of repairs. The economy of allowing buildings to deteriorate to such a condition is very doubtful, and certainly the insanitary conditions caused by such a state of affairs are sufficient to warrant keeping the buildings in better repair.

The buildings for the officers and employes of the institution, although somewhat inadequate for the needs of the institution, are generally in satisfactory condition. The nurses' cottage, housing some 200 people, is a wooden structure remodeled and repaired.

In the basement under Main building are located the kitchen, lecture room for the training class, and electric shop. The floors are concrete and the general condition of the basement was satisfactory when inspected. The basements under the other buildings are used to a very small extent for storage only. They are generally in fair condition except at cottage No. 2, where it is understood water enters the basement during a heavy rain to such an extent that it is necessary to bail it out with pails. This is a condition which should not exist and, therefore, should be eliminated by providing proper drains and protection of the walls to prevent the water entering.

While the stables and barns are evidently kept in a fairly good sanitary condition, better and more adequate facilities are needed in the way of a cow barn. An appropriation has been asked for constructing a new barn to accommodate 100 cows. It is evident that there is much need of such a structure.

As mentioned above, there are some low lands and stagnant ponds in the eastern portion of the grounds, caused by Fallkill creek. Two of the farms are located in this vicinity. Although these conditions probably afford favorable breeding grounds for mosquitoes, the conditions are not seriously objectionable. Otherwise, the grounds appeared to be in a very good sanitary condition.

Water supply

The water supply was recently made the subject of a special investigation by this Department, the date of the report thereon being March 10, 1914. Quoting from this report: "The hospital has its own supply derived from the Hudson river at a point near the hospital. The intake is about 50 feet from the eastern bank of the river and is protected by a crib work of timber filled with rock. From the river the water is pumped by low lift centrifugal pumps to the purification works which are on the bank near the intake. These works consist of a pumping station, a preliminary coagulating and sedimentation basin a dry alum feed device, two units of slow sand filters, a hypochlorite plant and a clear water basin. From the clear water basin the water is pumped directly to the institution by the high service plunger pumps. Two reservoirs with a combined capacity of about 3,000,000 gallons are located one mile east of the hospital These reservoirs serve chiefly to equalize the flow, receiving excess pumpage during the night and supplying some stored water during the day. The daily water consumption is estimated at 660,000 gallons or 165 gallons per capita per day.

"The intake to the pumping station is located only ¼ mile above the sewer outfall from the hospital itself and about 2 miles above the sewers of Poughkeepsie. It is said that on flood tide there is evidence of sewage matters in the close vicinity of the intake. Trouble has also been experienced at certain conditions of water level in the river due to insufficient depth of water at the end of the suction pipe from the low lift pumps and these pumps can be operated but 18 hours a day, the reserve storage in the coagulating basin being drawn upon to supply the high service pumps and filters. It has been proposed to extend this inlet some 300 feet northwest into the river to a ledge of rock. The water at this point is said to be free from the influence of the local sewer and to be of much better quality. No action has been taken in regard to this extension as yet."

At the time of this previous investigation the sand filters were out of service for the purpose of thoroughly cleaning the sand, the coagulation with sedimentation and the hypochlorite treatment being depended upon for purification. The rest of the report deals principally with the inefficient and unsatisfactory operation of the hypochlorite plant, which, however, has since been abandoned and a liquid chlorine plant installed and put in operation in its stead. Further improvements have been made as follows: The sand of the filters has been thoroughly cleaned and replaced, the sedimentation basin, clear water well and both the reservoirs have been cleaned, and the Fallkill supply

which furnished water for the cottage group has been abandoned and the filtered supply substituted instead. This later extension has increased the amount of water furnished by the purification plant to about 1,000,000 gallons daily. This amount will cause a rate of filtration of approximately 2,900,000 gallons per acre per day which corresponds favorably with the general practice for this type of slow sand filters.

An Electro-Bleaching Company apparatus is used for applying the liquid chlorine. The machine consists of a system of pressure regulating valves and an absorption tower. The object of the regulating valves is to deliver the chlorine gas in a constant rate to the absorption tower. The absorption tower is filled with pumice stone. A small stream of water enters the tower at the top while the chlorine gas enters at the bottom, the water thus absorbing the gas during its course through the pumice stone. The chlorinated water flows from the absorption tower through hard rubber pipes to the filtered water in a regulating chamber, just before entering the clear water well. A pressure gauge indicates the pressure of the chlorine gas and a rate gauge the ounces of liquid chlorine being applied per hour. No scales are provided with which to check the amount of chlorine being used, dependence being placed entirely upon the rate gauge. Because of possible variations in the flow of chlorine and also to check the accuracy of the rate gauge and assist in determining when the chlorine cylinder is empty, scales should be provided to check the amount of chlorine being used, by the loss of weight in the cylinder. The rate gauge reading at the time of the inspection was 1½ ounces, or a rate of 2¼ pounds per day, which, assuming 1,000,000 gallons of water used daily, is equivalent to .27 parts of chlorine per million.

A dug well furnishes the water at what is known as Traver place or East farm. The depth of the well is about 16 feet. It is stoned up with loose stone, has an open wooden curbing around it at the top, and the water is drawn from the well by means of a chain and buckets. The well is located about 40 feet from the edge of a pond caused by the creek which flows past the barn about 75 feet from the house, with the ground sloping toward the well, and about 100 feet from a privy having an earth vault and not in very good condition. While the slope of the ground is not directly from the privy toward the well, it is quite possible for the flow of the ground water to be in that direction.

There is a similar well at the Moore farm, which, however, is better located, in that the drainage is from the well toward the buildings in all cases. It is the same type of well but better protected, in that the upper part is screened, there being a door through which the water is drawn. The location of the well is along the highway about 75 feet from the house, 125 feet from the barn and 150 feet from the privy. The well is evidently kept in better condition than the one previously described.

Samples of water were taken from the main supply, also from each of these wells, and sent to the Division of Laboratories and Research for analysis. The results are given in the table below:

Nitrogen as				Oxygen consumed	Chlorine	Total hardness	Alkalinity	Bacteria	B. Coli		
Free ammonia	Albuminoid ammonia	Nitrites	Nitrates						10 c.c.	1 cc.	1 10 c.c.
FILTERED WATER SUPPLY											
.006	.018	.001	0.20	5.90	4.50	64.3	63.0	470	+	—	—
MOORE FARM WELL											
.002	.004	.005	4.80	0.50	5.75	188.6	150.0	90	+	+	—
TRAVERS FARM WELL											
....	....	....	....	....	....	....	....	230	+	+	—

The high bacterial count and the presence of B. coli in the filtered water supply indicate water of somewhat questionable quality. Previous analyses by the Division of Laboratories and Research were made before the installation of the liquid chlorine plant, and therefore are not representative of present conditions, but a number of analyses made at the institution laboratory since that time indicate in general a satisfactory water. The analyses of the water at the time of this inspection, however, indicate that the efficiency of purification at that time was not entirely satisfactory. Filtration alone should ordinarily remove practically all the bacteria, including those of the B. coli type, and final treatment with liquid chlorine, providing a sufficient amount is used, should complete the sterilization. Therefore the presence of B. coli in the above sample indicates that a sufficient amount of chlorine was not being applied. Owing to the large amount of organic matter commonly present in the Hudson river water, from 0.4 to 0.7 parts per million of chlorine would probably be required, depending upon variation in the organic content of the water.

It is evident that with proper regulation and operation of the present filtration and chlorination plant a satisfactory supply of water can be furnished the institution. An additional protection to the supply may be obtained by carrying out the recommendations contained in the recent report on the condition of the water supply regarding the extension of the intake into the river, where the water is less polluted, and also by providing a sewage disposal plant for treating the sewage before discharging it into the river, as discussed elsewhere in the report.

The results of the analyses of the samples taken from each of the wells indicate an unsafe supply. From the conditions surrounding the wells, especially the one at Traver place, this was to be expected. Unquestionably these wells should be abandoned and a safe supply from other sources or from the regular supply substituted.

Plumbing

The plumbing is all of the open type. It is in all cases provided with house traps and generally with fresh air inlets and vents. Some of the plumbing dates back for 26 years, and though part of it has been repaired and brought up to date, certain portions still consist of the antiquated fixtures installed at that time. In a number of cases the plumbing fixtures are old, of an unapproved type and in a bad condition, while in others the number of fixtures are entirely inadequate for the number of people they serve. The following instances are illustrations of these unsatisfactory conditions: In the cottages the plumbing is of an old type, the lavatory bowls being connected in series, and although the series of five bowls is provided with one trap, there are no vents. In the south wing of the main building some of the old style hopper toilets are still in use.

The following table is illustrative of the inadequacy of plumbing fixtures. The second column under each heading indicates the number of fixtures that should be provided:

LOCATION	Number of people	BATHS — SHOWER Number present	BATHS — SHOWER Minimum needed	BATHS — TUB Number present	BATHS — TUB Minimum needed	TOILETS Number present	TOILETS Minimum needed	LAVATORY BOWLS Number present	LAVATORY BOWLS Minimum needed
Central group, Wards 23, 24	150	1	4	0	1	7	13	12	13
Central group, Wards 21, 22	158	2	4	1	1	7	14	12	14
Central group, Ward 11	90	1	2	0	1	5	8	6	8
Main building, Ward 2	79	1	2	1	1	6	9	4	9

It has not been atempted to mention or list in the table above all the instances where the plumbing is unsatisfactory and inadequate, but simply to point out some specific cases where such conditions exist.

Drinking water is furnished from coolers by means of a common drinking cup. This method is insanitary, and although a problem of this kind is doubtless somewhat difficult to handle in an institution of this character, it would seem that the objection could be eliminated by providing drinking fountains or individual drinking cups.

Sewerage and sewage disposal

A sanitary sewer system collects the domestic sewage from the various buildings and conveys it to the Hudson river, where it discharges without treatment. The trunk sewer from the river to Central group is 12 inches and from the Central group to the cottages 8 inches. Six-inch pipe is used for all branches. The gradients of the sewers are good and manholes are conveniently and properly located. The branch to each building is provided with a screen chamber for the purpose of removing coarse materials such as rags, papers, etc., which the inmates are continually flushing into the sewers. These screens are cleaned once each week. They are provided with an overflow so that in case the screens become clogged the sewage will not back up into the sewers.

The fact that the institution discharges its sewage without treatment into the Hudson river has been the subject of previous investigations and criticisms by the Department. In 1893 Mr. C. C. Brown, consulting engineer, investigated the conditions then existing and in his report to the Department showed that the river was contaminated by the sewage from the hospital in such a way as to endanger the public water supply of the city of Poughkeepsie. Recommendations were accordingly made that the State Hospital be required to purify the sewage before discharging it into the river. Again in 1906 the contamination of the Poughkeepsie water supply by the hospital sewage was made the subject of a special investigation by the Department. The report thereon (twenty-seventh annual report, State Department of Health, page 758) pointed out the fact that, due to the configuration of the shores of the river between the sewer outlet of the hospital and the city water intake, the sewage from the institution tends to hug the shore and is thus during ebb tide carried more directly to the city water intake. Recommendations were also made at this time that the State Hospital construct a disposal plant for purifying its sewage before discharging it into the Hudson river. Not only are the conditions such as to menace the quality of Poughkeepsie's water supply, but, as has been pointed out previously in this report, the institution supply is also subject to pollution from the same source. An investigation and report to the hospital concerning the proper method of disposal of the sewage was made by Hazen & Whipple, consulting engineers, in 1907 or 1908 and referred to on page 206 of the 1908 annual report of the Department of Health. The report of the consulting engineers suggested three alternate methods of disposal, but none of them have been carried out. It is evident from the above that the present method of discharging the sewage from the hospital into the Hudson river without treatment is insanitary and a menace to the health not only of the patients at the institution but also the city of Poughkeepsie.

Privies are used at the farms and some of the other more remote buildings. Some of them were not in an entirely satisfactory condition. This was particularly noticeable at Travers or East farm, where an earth vault privy is located only about 100 feet from the well. There is no indication of disinfectant being used, and, in fact, the conditions about it were generally insanitary. Privies should either be abolished and sewer connections made, or they should be kept in the most sanitary condition possible.

Garbage disposal

The kitchen garbage is sold to nearby farmers, who feed it to pigs. Wooden barrels with covers are provided for receiving the garbage from the kitchens.

They are collected daily. Other garbage is disposed of at a dump in a remote portion of the grounds. The method of garbage disposal appeared to be satisfactory at the time of the inspection.

Heating and ventilation

Steam is principally used for heating, although a few of the tenement houses are heated by stoves. The direct system of radiation is most commonly used. However, the industrial building, the library, the amusement hall and the superintendent's and officers' cottages are provided with the indirect system. The heat is evidently sufficient, except possibly in some cases where, due to the degenerate class of patients, it is necessary to keep the windows open to a great extent for ventilation. This, however, is more a matter of ventilating than heating.

Natural and forced ventilation are both used in the institution. In some cases the fresh air is taken directly from outside the buildings, while in others it is taken from the basements. The north wing of Main group and Central group are provided with forced ventilation, the air being drawn from outside the buildings, while Inwood and the cottages are provided with flues for natural ventilating, the air also being taken from without the buildings. The main building and south wing of Main group are provided with ventilating flues, but the air is drawn from the basements. This latter system is not so satisfactory as the other two and doubtless results in inefficient ventilation in those buildings affected by it. As intimated above, it is also evident that in certain wards the ventilating facilities are insufficient for the class of patients kept in them, who, because of their degenerate condition, require exceptional facilities in this line.

As stated above, the institution at the time of the inspection was caring for 419 more inmates than it has a certified capacity for, and the enrollment at one time reached an excess of 459. These figures correspond to enrollments 15.5 per cent. and 16.9 per cent., respectively, greater than the rated capacities.

This in itself indicates that overcrowding must exist in the wards. The following table indicates to some extent these unsatisfactory conditions:

LOCATION	Size	Number beds	Floor space per bed	Air space per bed
	Feet		*Sq. ft.*	*Cu. ft.*
Main group — Wards 17 and 18	42 x 60 x 14	76	33.2	464
Cottage No. 3 — one ward	20 x 24 x 13	11	43.7	567
Cottage No. 7 — one ward	22 x 36 x 13	16	49.5	643
Cottage No. 7 — one ward	24 x 28 x 13	16	42.0	546
Inwood — one ward	40 x 60 x 12	54	44.4	533

No attempt has been made to list all the wards where overcrowding exists, but simply to indicate a few to illustrate the insanitary conditions. In all cases there should be at least 50 square feet of floor space and 600 cubic feet of air space per bed, and in many cases where sick or degenerate patients are quartered these figures should be correspondingly increased.

Lighting

Electricity generated at a central plant is used for artificial lighting. The following list gives the number of lights in the various buildings or groups of buildings:

Main building	573
North wing	791
Staff house and superintendent's residence	293
South wing	1,819

Reception hospital	292
Greenhouse, barns, farmers' house and isolation pavilion	155
Pumping station	87
Amusement hall and library	266
Boiler house, coal pockets and electric station	157
Inwood and Central group	1,713
Edgewood and Central group	312
Cottages	514
Central group chapel	145
Cottage chapel, shed and boiler house	79
Total	7,186

Thus there is a total of 7,186 lights for lighting the buildings. A total of 229 lights are conveniently distributed about the grounds.

The facilities for artificial lighting appear to be satisfactory.

The windows are sufficient in number, adequate in size and properly placed for furnishing satisfactory natural light.

Fire protection

The elevation of the 3,000,000-gallon storage reservoir which furnishes fire protection for the most of the institution is about 100 feet above the main group, and thus gives a fire pressure of only about 40 pounds, which is insufficient to furnish a satisfactory fire stream, especially in view of the fact that some of the buildings are four stories high. At Central group, Inwood and Edgewood the pressure from this same source is only 15 or 20 pounds, just sufficient for domestic purposes. The 60,000-gallon standpipe on Cottage Hill, which supplies water to the Cottage group, is fed by an 8-inch main from the pumping station at the Main group. This main is used very little, if at all, to furnish water directly for domestic purposes. Therefore, since the elevation of the reservoir is some 190 feet above Central group and 260 feet above main group, it is possible that hydrants connected with the main supplying it would somewhat relieve the unsatisfactory conditions now existing. The capacity of the main, however, is sufficient to supply only three or four good fire streams and the 60,000-gallon storage sufficient for only about one hour's supply for fire protection. In view of the above it is evident that greater water storage is needed at a point where a satisfactory pressure can be maintained for fire protection and also that the main connecting it with the water system of the institution be adequate in size to supply a sufficient number of fire streams, in addition to the domestic supply tributary to it. This is a matter which the institutional authorities should take up immediately, with the view of providing the necessary facilities as soon as possible.

A total of 54 hydrants are located about the grounds. About 30 of them are suitably located about the Main group, but Edgewood is provided with only one, central group with three, Inwood with two and the cottages with one each. It is evident that more hydrants are needed at the last three mentioned groups. Two hose carts with 500 feet of fire hose each are located at both the Main and Central groups and one similarly provided with hose at cottage 3. For fire protection service within the buildings standpipes are provided, with hose attached, in each ward. Except in a few cases fireproof fire escapes are satisfactorily provided. There is an organized fire company and a fire marshal, whose whole time is devoted to this one duty. The city fire department may be called upon in case of fire.

In view of the fact that the methods of fire protection at the institution has been the subject of an investigation by the State Fire Marshal, the subject will not be dealt with in detail in this report. However, it is important to note that the recommendations of the Fire Marshal include the construction of a concrete reservoir on Cottage Hill for the purpose of furnishihg sufficient storage and better pressure for fire protection and also additional fire escapes in some cases, changing of wooden to fireproof fire escapes and changing of some exits from inward to outward going. These recommendations, if carried out, would probably furnish satisfactory fire protection at the hospital.

Foods

About 60 per cent. of the milk used at the institution is furnished by contract on competitive bids, the rest from the institution herd. At the time of the inspection four different contracts were in force. Information obtained at the time of the inspection indicates that three of the dairymen furnish milk from their own herd only and that their dairies are inspected at least twice yearly by the steward of the hospital. The fourth contractor, however, is a dealer in dairy products who gets his supply of milk from various sources, which are not inspected probably because these sources of supply are more numerous and doubtless continually changing more or less. The specifications for the milk require the cows from which milk is produced to be "healthy and show no signs of physical disease," that they be fed "only wholesome food and water," and that the stable be kept in a clean and sanitary condition; also that the barnyard be "well drained and cleaned," the pails, cans, etc., "be in good condition and thoroughly cleaned after each using and that the milking be done in a cleanly manner." They further provide that "milk shall be removed immediately from the stable to a milk house used for that purpose only and cooled to a temperature not to exced 50 degrees Fahrenheit and held at that temperature until delivered at the institution in a fresh condition once or twice daily as required." Proper and efficient supervision by the hospital authorities to insure the enforcement of the specifications should result in a good quality of milk being supplied to the institution. However, it is evident that such is not the case in respect to at least the supply furnished by the dealer who receives the milk from several different sources.

The institution has a herd of about 80 cows, which are inspected twice yearly by a representative of the State Agricultural Department, and although a recent inspection indicated the presence of seven tubercular cattle, they were slaughtered, and a later test has indicated the rest of the herd to be free from tuberculosis. At the time of the inspection the herd was located at one of the farms in the eastern portion of the institution grounds, where it was being kept during the summer. The barn at this place where the milking was done is provided with only 14 stanchions. The floor is of wood and in satisfactory condition. The ventilation would be insufficient under ordinary conditions, but is probably satisfactory under present conditions in view of the fact that the cows were only in the stable during milking. The milk was strained into the milk cans in the barn, there being no provision for cooling. Provision is made for heating water for the purpose of scalding the milk pails and utensils.

The winter cow barn, located near Central group, is provided with a wooden floor which is decayed in places and generally in a bad state of repair. The floor in the milk room adjoining the barn is also of wood and in an insanitary condition. It is evident that this barn, in addition to being old and not in good repair, is inadequate for the needs of the institution.

Occasional analyses of the milk from the various supplies are made at the institution laboratory both as to its physical quality and the bacterial contents.

From the above it appears that, in view of the several sources of the milk supply being furnished from without the institution, the control of the quality of milk must be rather difficult, and it further appears that the institution itself is not conforming to its own specifications in the production of its milk, in that sanitary conditions at the dairies are not satisfactory and coolers are not provided at the dairies for cooling the milk. It would undoubtedly be better if the institution were provided with the necessary facilities and stock to produce all the milk used at the institution under modern and sanitary conditions. If such provision cannot be made, a modern pasteurizer should be provided for pasteurizing the milk to insure a safe quality.

The meat is purchased by the purchasing committee of the State Hospital Commission. Native beef was being used at the time of the inspection. Butter and eggs are purchased on the open market. Most of the vegetables except potatoes, many of which are bought, are raised at the institution. All foods are received at the storehouse and are inspected and checked up by the

storekeeper, except that the meat is inspected by the steward and the butcher. The chefs also inspect the foods as received at the kitchens and a general chef inspects the conditions of the cooked foods prepared at the various kitchens. No unsatisfactory foods were found on hand at the time of the inspection and it was evident that they were being well cared for.

A general storehouse is provided for the storage of foods and supplies. Its equipment includes a refrigerating plant which, in addition to supplying cold storage, manufactures some ice. Ice is also supplied from Fallkill lake, which formerly was the source of water supply for the cottages, but was abandoned because of its insanitary condition. It appears that this ice is used in drinking water. A cooler 21x22 feet is provided for fresh meat and one 14x22 feet for salt meat. A cooler 13x22 feet is provided for butter and eggs and one 18x24 feet for cheese and fruit. In general the sanitary conditions at the storage appeared satisfactory. However, one of the institutional authorities stated that more room was needed.

Culinary department

The size, condition and arrangement of the dining rooms vary considerably in different parts of the institution. In general the food is conveyed to the larger dining rooms from the kitchens by dumb waiters and is received in serving rooms which adjoin the dining rooms, and are provided with steam tables for keeping the foods warm while being served. In some of the smaller buildings the dining rooms are on the same floor and adjoin the kitchens. In some cases door and window screens were not properly provided and in a few cases the floors were worn and insanitary, this especially in some of the cottages. Tile floors are provided for a few of the dining rooms and certainly are much preferable to wooden floors in all cases. A mechanical dish washer is provided in B dining room. In the others the dish washing is done by hand. It is doubtful if this latter method insures thorough sterilization of the dishes in all cases. The general condition of the dining rooms as to cleanliness, dishes, etc., appeared satisfactory when inspected.

The main kitchen at Main group was serving a population of 1,387 at the time of the inspection and the Center kitchen at the same group 149. The kitchen at the reception hospital was serving 120, B kitchen at Central group 688, Edgewood kitchen 296, Inwood kitchen 523, and each of the kitchens at the eight cottages about 50 each. Employes and inmates are both served from these kitchens.

The main kitchen at Main group is provided with a tile floor and appeared to be adequately supplied with ranges, cookers and other necessary utensils. The windows and doors were screened. The foods are conveyed from this kitchen to the dumb waiters, serving the various dining rooms above in enclosed food cars. In general the sanitary conditions appeared to be quite satisfactory here, but there is some indication that more room is needed for the scullery. The equipment in the other kitchens appeared to be satisfactory, but in some cases they were not sufficiently provided with window and door screens, and consequently flies were quite numerous in these, while in others, particularly some of the cottage kitchens, the wooden floors were in very bad condition.

The bakery is equipped with a mechanical mixer and steel dough troughs, but the moulding is done by hand. The sanitary conditions here appeared to be quite satisfactory.

Clothing and bedding

Most of the clothing and bedding is made at the institution from raw material, some of which is purchased from the State Prison Department and some in the open market. The clothing is issued on requisition made by the nurse in charge of the ward, being first approved by the supervisor or physician in charge. The condition of the clothing and bedding appeared satisfactory when inspected.

Laundry

The laundry is a part of the Main group It is equipped with 12 washers, 5 extractors, 3 large mangles, collar and cuff ironer, dryers and other necessary apparatus. A steam sterilizer is also provided and is so arranged that infected clothes are received in a separate room, from which they are put directly into the sterilizer and are later taken directly from the sterilizer into the main laundry, thus eliminating the possibility of the infected clothes coming in contact with the noninfected. In general the facilities and conditions at the laundry appeared to be quite satisfactory.

Cleaning

The cleaning is largely done by the patients under the supervision of attendants. The general condition of the institution in this respect appeared to be satisfactory when inspected.

Bathing facilities

Spray baths are used almost entirely for the patients, although tub baths are provided to some extent for special cases, it evidently being the practice to have one tub available for each ward. A bath and change of clothing are required at least once each week and in the case of some of the more degraded patients more often. The bathing is supervised by the physician in charge of the ward and is directly overseen by attendants. As pointed out above in connection with the plumbing, the bathing facilities for some of the wards are entirely inadequate, in one case there being only one shower bath for 150 patients.

In some cases shower and other tub baths are provided for the employes and officers of the hospital. It is evident that these facilities are fairly adequate.

Fresh air and exercise

During the summer the patients are out of doors practically all the time during the day. In the winter they are in general out an hour in the forenoon and an hour in the afternoon, depending, however, upon the physical condition of the patient. A few of the patients work six and seven hours during the day, some others three or four hours and some not at all. There is no enforced exercise nor work, it being a matter of persuasion to induce the patients to do what is wanted. It appears that there is an abundant opportunity for both fresh air and exercise.

Recreation

The hospital is provided with a library, which is quite extensively used by the inmates under certain necessary restrictions. Entertainments are given twice each week for the patients in the form of either dances, moving pictures or concerts. The patients may dance with each other or with the attendants. Cards, checkers, billiards, etc., are also allowed among the patients under certain conditions It is evident that the patients are sufficiently cared for in this respect.

Hospital facilities

Space and general equipment.— The wards of the institution are divided into certain groups or divisions which are termed services. Each of these services is under the direct supervision of a senior assistant physician. Certain wards in the different services are set aside for the sick, there being no regular hospital for this purpose. The plan appears to be satisfactory and evidently meets the needs of the institution.

Two of the cottages, located in the eastern section of the grounds and about two miles from the main group, are used for tubercular patients, one for men and one for women. Large open verandas are provided here, which furnish

outdoor sleeping quarters for a limited number of patients. The capacity of the cottages is 50 each, the two thus accommodating only 100 patients, while there are 135 or 140 tubercular patients in the institution. There is no provision here for the care of disturbed patients who are tubercular. It is evident that there is needed at the institution a hospital for the tubercular insane, one properly constructed and equipped for efficient treatment of all the patients who are affected with the disease.

Operating room.— The operating room is located in the main building. The light in it is good and it appeared to be in very good condition. It is equipped with a sterilizer and the necessary instruments regarding which no criticism was offered.

Dispensary and drugs.— The dispensary is located at the main group and is in charge of a registered pharmacist. Certain stock supplies, however, such as anesthetics, salts, etc., are kept in each of the wards. The head nurse has charge of these and they are kept in a locked cabinet. Other drugs are dispensed by the pharmacist in individual doses and only upon a physician's prescription.

An estimate of the drugs needed is sent to the Hospital Commission at Albany, and if approved is returned and the purchase made by the steward on competitive bids. The drugs are evidently kept in containers properly labeled.

Nursing.— The number of nurses throughout the institution is maintained at a ratio of approximately one for every eight patients. The ratio, however, varies in the different wards, depending on the grade and character of the patients. Each nurse is on duty for 11 hours on one day and for 14 hours on the next day, alternately. A total of 66 days' vacation is allowed during the year, or equivalent to every Sunday and two weeks' vacation. In addition to this every other holiday is allowed.

Medical attendance.—As stated above, each service is directly in charge of a physician. He regularly each day makes the rounds of the wards. The patients are constantly in charge of attendants or nurses, who immediately report any illness to the physician in charge. A complete list of the medical staff is given below under the heading "Organization and Administration."

Quarantine and disinfection.—An isolation hospital with a capacity of six patients is provided for quarantine. The main part of the building is divided into two parts, with three separate rooms and toilet facilities in each. There is also a dining room and kitchen, from which each part may be entered directly. It would seem that the capacity of this building is hardly sufficient for the needs of the institution, especially in view of the fact that there appears to be no other provision for quarantine. Should there be an epidemic of a contagious disease, as diphtheria, it would doubtless be very difficult to properly quarantine those affected.

Employes are sent for the patients committed to the institution and these patients are not received if it is known that they have been recently exposed to any contagious disease. Body cleanliness and new clothing are also required before the patients will be received. When brought to the institution the patients are taken to the reception hospital, where they are at once bathed and examined by a physician. They are vaccinated soon after admission, but no throat cultures are taken. Those entering are not isolated unless there are indications of some disease. They are, however, retained at the reception hospital under observation for some time before being transferred to one of the other wards.

It is evident from statistics of other institutions that a large number of those entering are diphtheria carriers. Although diphtheria has not been prevalent in the institution, it has been present to some extent. In view of these facts it would appear advisable to take throat cultures of all the patients upon entering and to hold them in quarantine until the results of the analyses are obtained and if positive to retain the patients in quarantine until negative results are obtained.

Pathological work and equipment.— The laboratory is located in a separate building at the Main group. It appeared to be well equipped for both pathological and bacteriological work, but it is evident that more room is needed to satisfactorily carry on the large amount of this work now being done at the institution. A certain amount of routine work is also done at the reception hospital.

The following list of the work done during the year ending September 30, 1915, gives an idea of the character and extent of this work being done at the institution.

Laboratory examinations

Blood examinations	165
Lumbar punctures	132
Sputum examinations	212
Throat cultures	189
Urine examinations	487
Vaccines prepared	78
Wassermann reaction	384
Miscellaneous, smears, cultures, milk, water, etc.	196
Total	1,843
Examinations made at reception hospital:	
Blood examinations	11
Sputum examinations	18
Urine examinations	566
Total	595
Laboratory examinations	1,843
Total examinations at institution	2,438

Mortuary.— The mortuary adjoins or is a part of the laboratory. Its capacity is four bodies, there being a separate compartment for each. The compartments are cooled by the ammonia system. The floor is tile. The conditions here appeared satisfactory and the facilities are evidently adequate for the needs of the institution.

Organization and administration.— The hospital is governed by a board of managers, appointed by the Governor and confirmed by the Senate. The board of managers appoint a Medical Superintendent who is the chief executive officer of the hospital and, subject to the regulation of the board of managers, has the general superintendence of the hospital property and the general direction of the policy of the institution. The Superintendent also consults with the Commission of Lunacy, whenever called upon to do so regarding matters relating to the care and maintenance of the hospital.

Below is a list of the board of managers and officers of the institution:

Board of managers

Frank B. Lown, President	Poughkeepsie
Peter H. Troy, Secretary	Poughkeepsie
Catherine A. Newbold	Poughkeepsie
Myra H. Avery	Poughkeepsie
E. Lyman Brown	Wappinger Falls
William B. Dinsmore	Staatsburg
Horatio N. Bain	Poughkeepsie

Treasurer

S. Louis Schnitzer	Albany

Counsel

Hon. Egbert S. Woodbury, Attorney-General .... Albany

Resident officers

Charles W. Pilgrim, M. D. .... Medical Superintendent
Frederick W. Parsons, M. D. .... First Assistant Physician
Willis E. Merriman, M D. .... Senior Assistant Physician
Mortimer W. Rayner, M. D. .... Senior Assistant Physician
William J. Cavanaugh, M. D. .... Senior Assistant Physician
William C. Porter, M. D. .... Senior Assistant Physician
Howard P. Carpenter, M. D. ...... Senior Assistant Physician and Pathologist
Percy L. Dodge, M. D. .... Assistant Physician
Ross D. Helmer, M. D. .... Assistant Physician
T. G. De La Hoyde, M. D. .... Assistant Physician
Clarence Russell, M. D. .... Assistant Physician
Barbara Curtis, M. D. .... Woman Physician
Blanche Dennes, M. D. .... Woman Physician
Florence A. King, M. D. .... Woman Physician
Leona E. Todd, M. D. .... Woman Physician
J. Melvin Taylor, M. D. .... Medical Interne
Miss Margaret J. Clancy, R. N. .... Principal of Training School
George R. Finton .... Steward

Ophthalmologist

W. G. Dobson, M. D. .... Poughkeepsie

Dentist

Mitchell Downing, D. D. S. .... Poughkeepsie

In view of the results of this investigation as chronicled in the above report, I beg to submit the following conclusions and recommendations:

Conclusions and recommendations

1. That, in view of the insanitary conditions and inadequacy of certain buildings:

(a) The walls, ceiling and floors of the cottages, described in detail in the body of this report, be properly repaired and that any other repairs necessary to put these or any other buildings at the institution in a satisfactory and sanitary condition, be made as soon as possible.

(b) The proper drains or protection be provided to prevent water entering the basement under cottage No. 2.

(c) The institution is much in need of a new and modern cow barn of sufficient capacity to satisfactorily care for all the milch cows at the institution, and that if the old barns are still to be used for milch cows they should be repaired and put in a sanitary condition.

2. That, in view of the unsatisfactory condition of the water supplies in certain respects, as pointed out above;

(a) Scales should be provided to check the amount of chlorine being used and further the amount used be increased to not less than 0.4 parts per million.

(b) The wells furnishing the water supplies at the Travers and Moore Farms be abandoned and safe supplies substituted instead.

3. That, in view of the unsatisfactory type of plumbing fixtures still being used in some cases and also of insufficient fixtures:
   (a) All obsolete and insanitary plumbing fixtures be replaced by those of a modern type.
   (b) In all cases where bathing and toilet facilities are inadequate, sufficient additional facilities be provided to eliminate this difficulty.
   (c) The use of the common drinking cup be discontinued and drinking fountains or some other sanitary method adopted.

4. That in view of the possibility of the contamination of the water supplies of the institution and of the city of Poughkeepsie, by the discharge of sewage from the institution into the Hudson river without treatment, the institutional authorities at once take the necessary steps to provide an efficient sewage disposal plant for treating the hospital sewage.

5. That, in view of the insanitary condition of some of the privies being used in various portions of the grounds they either be abandoned and adequate toilet facilities provided or that they be placed and maintained in the most sanitary condition possible.

6. That, since the ventilation appears to be inadequate in some cases and the wards generally overcrowded;
   (a) In those cases where the supply of fresh air is taken from the basements the necessary changes be made to draw it directly from outside the buildings.
   (b) In the wards where the more degraded patients are quartered and it is evident that more ventilation is needed, better facilities be provided.
   (c) Sufficient space to furnish not less than 50 sq. ft. of floor space and 600 cu. ft. of air space per bed be provided.

7. That sufficient water storage with adequate pressure and proper connections for fire protection be provided and also more hydrants where needed, and further, that sufficient fire proof fire escapes and adequate out-swinging exits be provided in all cases

8. That the institution either provide the necessary stock and facilities for satisfactorily producing at the institution all the milk used, or that all milk from outside sources be pasteurized with a modern pasteurizer and, furthermore, that more sanitary conditions be maintained at the institution dairies.

9. That the practice of using the natural ice obtained from Fallkill lake, in direct contact with drinking water be discontinued.

10. That regarding the culinary department;
   (a) Window and door screens be adequately provided for all dining-rooms and kitchens,
   (b) Mechanical dish washers, supplied with an abundance of hot water should be provided where they are not already in use.

11. That, in view of the evident inadequacy of quarantine facilities and of the tubercular hospitals;
   (a) More adequate facilities be provided, that the patients may be better cared for in this respect.
   (b) Throat cultures be taken of all patients upon entering, that they be held in quarantine till the results of the cultures are obtained and that when the results are positive the patients be retained in quarantine until negative results are obtained.

12. That, there is insufficient room at the Laboratory to satisfactorily carry on the amount of work being done in this department and, therefore, that more room should be provided.

Respectfully submitted,

THEODORE HORTON,
Chief Engineer

ALBANY, N. Y., *January* 4, 1915

ROCHESTER STATE HOSPITAL (Rochester)

HERMANN M. BIGGS, M. D., *State Commissioner of Health:*

I beg to submit the following report on an investigation of the sanitary condition of the Rochester State Hospital made at your direction by Mr. C. A. Holmquist, assistant engineer of this Department, on February 8 and 9, 1915:

Location and general description

Location.— Rochester, Monroe county
Certified capacity.—1,268 inmates
Present population.— Inmates, 961 women; 615 men; total, 1,576 inmates; 281 attendants; total population, 1,857
Class of inmates.—Insane
Area of grounds.— 207 acres in Rochester and 62 acres at the so-called Lake Farm in the town of Webster
Number of occupied buildings.— 20
Site of institution.—The main groups of buildings comprising the main portion of the institution are located in the southern part of the city of Rochester, about one mile east of the Genesee river and at elevation of about 60 and 560 feet above the river and sea level respectively. The so-called Lake Farm maintained by the hospital on the shore of Lake Ontario is located about 4 miles north of the village of Webster, Monroe county, and about 16 miles from the hospital. The general elevation of the farm is about 40 feet above the level of the lake. The slope of the ground both at the hospital and farm is such as to provide good surface drainage and the sandy nature of the soil makes the sites fairly dry.

Buildings

General description of buildings.— There are two main groups of buildings in the city of Rochester, viz., the North or Monroe group comprising the administration building, 4 buildings containing wards for women, 1 building containing dining-rooms and amusement hall and the kitchen building, all of which buildings are connected with covered corridors; and the new or South group comprising 2 buildings used as wards for men, 1 building containing infirmary wards for women and men, and the kitchen building, also connected by corridors. There are also a number of isolated buildings including two nurses homes, superintendent's and steward's cottages, storage house, power house, bakery, paint shop, carpenter shop, soap factory, farm house and barns and sheds. At the Lake Farm in the town of Webster there are several buildings including the farm cottage for employes and inmates, 3 pavilions for inmates, barn or stable, ice house and pumping station.

General physical and sanitary conditions of buildings.— All the buildings of the main hospital except the farm house, shops and sheds are of brick. The other buildings are frame structures. The Monroe group which was formerly the Monroe County Insane Asylum, is very old. The South group is only some 12 years old and is of more modern construction. The rooms in the main groups are from 10 to 12 feet high and are well laid out with respect to sunlight. The buildings are said to be adequately screened against the access of flies during the summer. The main buildings are all provided with cellars or basements with tile or cement floors. They appeared to be adequately drained and were dry at the time of the inspection. The basements in the main groups are used as means of communication between the different buildings and for carrying the piping systems. A school room gymnasium and two works shops are also located in the basements of the Monroe group. The carpenter shop and soap factory are both old frame buildings improperly equipped and inadequate for the needs of the institution. There is no dust removing apparatus in the carpenter shop and the equipment of the soap factory is old and in an unsatisfactory state of repairs. The plumbing fixtures in both buildings are also old, obsolete, insanitary and inadequate. The buildings, moreover, are veritable

fire-traps and should be abandoned and new buildings constructed in their places.

The stables of the institution were cleaned at the time of the inspection and although the manure removed from the stalls at the main stable and placed outside is not screened, it is removed daily to a manure storage pile located about 1/4 of a mile from the main group of buildings.

The Lake Farm property which has been recently acquired by the institution is located on the shore of Lake Ontario and is to be occupied both winter and summer by convalescent patients. It is also to be used as picnic grounds and a regular place for outings. It is planned to accommodate 7 patients during the winter and 45 patients at the farm during the summer.

Water supply

The water supply of the hospital proper is derived from a driven well on the institution property and from the Hemlock lake supply of the city of Rochester. Owing to the excessive hardness of the well supply this water is not used for laundry nor boiler purposes It was learned that the institution contemplates softening the well water, and using it for all domestic purposes in which event the Rochester supply will be used only as an emergency or auxiliary supply.

The driven well is located near the hospital ice pond about 1/2 mile east of the main group of buildings and is one of a number of similar wells driven about 20 years ago at this site for the purpose of furnishing the city of Rochester with water. After having been so used for nearly a year the wells were abandoned because the city obtained water elsewhere.

Only two of the wells are used by the institution at this time, one for domestic purposes and the other for filling the ice pond. The remainder of the wells have been plugged. The well used for domestic purposes is 65 feet deep, is driven through 12 feet of clay, 6 feet of gravel and 47 feet of limestone and is cased with an 8-inch cast-iron casing for the entire distance. The top of the well is surrounded with a concrete basin which extends above the surface of the ground and contains the necessary valves for controlling the flow. The water is raised in the well by an air lift and discharged into either of two covered air lift pump wells from which it is discharged against a head of 135 feet through a 10-inch cast-iron pipe into a stand pipe 85 feet high and 20 feet in diameter located on fairly high ground south of the south group of buildings.

There are no permanent sources of pollution near the well, which is protected from surface wash. The casings of the wells not in use are carried above the surface of the ground and although plugged are not effectually sealed. I am of the opinion that the casings of the wells not in use should be hermetically sealed in order to protect them from incidental or wilful pollution inasmuch as they all probably reach the same water-bearing stratum and any pollution entering one well would, therefore, affect the remainder of the wells.

The institution has recently acquired a small farm known as the Smith Farm located about 1/2 mile southeast of the main group. There is at present a dug well located some 50 feet south of the farmhouse and some 100 feet from an earthen vault privy. It was learned that the farmhouse is to be renovated, new buildings constructed, modern plumbing installed and a sewage disposal plant constructed. The privy and well will then be abandoned and the farm supplied with water from the deep well supply by making a connection with the force main leading from the pumping station to the stand pipe.

Although the slope of the ground is from the well towards the privy it is, nevertheless, comparatively close to the well and inasmuch as the well will probably be used somewhat until the deep well supply becomes available the privy should be removed as far from the well as possible and the privy vault cleaned and thoroughly disinfected in order to remove this possible source of pollution.

The water supply for the Lake Farm is derived from a covered spring located about ¼ of a mile south of the farm buildings. The spring is covered with a concrete basin and the water flows into the basin through a number of pipes driven through the bottom of the basin into the water-bearing sand and gravel. From this basin the water flows by gravity through a 2-inch iron pipe to the suction well of a pumping station located near the foot of a steep slope some 200 feet south of the barn. This pump well is covered by a concrete structure equipped with an electrically driven pump by means of which the water is pumped into an air pressure tank located in a small room adjoining the storage room under the wagon room of the barn building. The water is distributed from the tank under a pressure of about 60 pounds per square inch.

As noted above the pumping station is located at the foot of a steep slope some 20 feet high and although the station is constructed of concrete it is probably not water-tight and there is a possibility of ground water seepage into the well. No manure or compost should, therefore, be placed on the land above and within 100 feet of the pumping station. There appeared to be no other source of pollution.

Results of analyses of samples of water collected from the different sources of supply are given in the following table:

Parts Per Million									B. Coli		
Nitrogen as											
Free ammonia	Albuminoid ammonia	Nitrites	Nitrates	Oxygen consumed	Chlorine	Total hardness	Alkalinity	Bacteria	10 c.c.	1 c.c.	1-10 c.c.
TAP WATER FROM HEMLOCK LAKE SUPPLY											
....	....	....	....	....	....	....	....	110	—	—	—
TAP WATER FROM DEEP WELL SUPPLY											
.004	Trace	.001	1.00	1.10	14.75	321.5	251	45	—	—	—
TAP WATER FROM SPRING SUPPLY AT LAKE FARM											
.002	.002	.002	0.80	1.20	3.38	154.2	153.0	30	—	—	—

The results of these analyses confirm our previous conclusions with respect to the satisfactory quality of the portion of the water supply furnished by the city of Rochester from its Hemlock lake supply as indicated by past records. The deep well supply, however, appears to be very hard and to be high in nitrates and clorine and low in bacterial count and free from B. coli. The high chlorine, oxygen consumed and nitrates would ordinarily indicate sewage contamination but the position of the wells together with the fact that the ammonias and nitrites are low as well as bacteria with the absence of B. coli show clearly that no active contamination occurs. The water from the spring used for water supply purposes at the Lake Farm is of similar quality to the deep well supply except that it is considerably softer than that supply and is lower in chlorine as might be expected. Here also the low bacterial count and the absence of bacteria of the B. coli type would indicate freedom from active contamination.

Plumbing

In the north or Monroe group the plumbing, although open, is for the most part old and is in an unsatisfactory condition. It was learned, however, that contracts for the installation of an entirely new system of modern plumbing in this group are to be let this spring, and it was noted in a recent issue of one of the engineering periodicals that the institution was advertising for bids on this work.

The plumbing in the south group is of more modern type, having been installed about 12 or 13 years ago, and the plumbing and fixtures appeared to be in a satisfactory state of repair. The piping system is constructed on the loop system, that is, the branch soil pipes are carried up and connected with the main stack above all fixtures. All main house drains at the hospital are trapped and have fresh air inlets. Aside from the fact that the plumbing system of the Monroe group was old and obsolete, the number of fixtures in the different wards of both groups of buildings excepting in the reception building were found to be inadequate to satisfactorily meet the needs of the present population. Although no attempt was made to record all cases where inadequate plumbing facilities were found to exist, the following table gives a list of places where such conditions were found. In the first column is given the number of the ward, in the second the number of occupants and in the remaining columns, under each type of fixtures, is stated the existing and the proper number of fixtures:

WARD	Number of occupants	Toilet Seats		Lavatories	
		Present number	Required number	Present number	Required number
11	79	4	6	8	8
12	61	4	5	5	6
10	75	4	6	5	7
3	72	2	8	5	7
6	104	5	10	10	10
9	143	5	12	8	14
33	80	3	7	4	8
31	30	3	4	4	5
36	63	3	5	4	6
53	52	3	4	4	5

It will be noted from this table that the number of toilet seats and lavatories are in some cases less than one-half as many as should be provided. This condition, it is understood, will be remedied to a certain extent in the Monroe group when the new plumbing system is installed, at which time it is proposed to provide additional toilet facilities by placing fixtures in some of the single sleeping rooms of the different dormitories and thus converting them into toilet rooms.

It was also found that the bathing facilities in most of the wards, especially in the Monroe group, where each bathroom containing one shower bath and a tub, serves two wards having a total of from 130 to 228 patients. In some instances an additional tub bath is provided. It may be stated in general that not less than two shower baths and one tub bath per 100 patients should be provided.

It was found that the common drinking cup is in use in this institution. This constitutes a violation of regulation 3 of chapter 7 of the Sanitary Code prescribed by the Public Health Council, which prohibits the use of the common drinking cup in any public place or public institution, etc. Although it may not be practicable to provide individual drinking cups for all patients in an institution of this kind, I am of the opinion that it would be possible to provide individual drinking cups for the so-called bed patients and drinking fountains for the other patients and that steps should be taken to abolish the use of the common drinking cup as soon as possible. It was learned at the time of the inspection that the institution, realizing the danger in the use of the common drinking cup, has asked for appropriations for the installation of drinking fountains, but that so far no appropriation has been granted.

Sewerage and sewage disposal

The sewage of the main group of buildings of the institution is discharged by gravity directly into the east side trunk sewer of the city of Rochester, which passes through the institution grounds. The sewage from the superintendent's cottage, farm buildings, soap factory and other buildings, lying too low to connect with the east side trunk sewer by gravity, flows to a pumping station, whence it is pumped into the east side trunk sewer. This pumping station is equipped with two centrifugal pumps driven by automatically operated electric motors. The electric current to operate the motors is generated at the institution and was said to be more reliable than the municipal electric supply. The pumping station is provided with an overflow connected with a storm sewer which discharges into a small stream tributary to Allen creek and Irondequoit river.

It was learned at the time of the inspection that the sewage from the low level section of the property formerly discharged into an old pumping station provided with a single pump and motor and that the new pumping station, provided with duplicate pumping equipment, was constructed during the past winter and recently put in operation. It appears, however, that no plans for the pumping station were submitted to or approved by this Department, as required by section 14 of the Public Health Law.

The drippings from the engine room, the washings from the floors of the soap factory and the drainage from the stables are discharged with the storm water into a small stream tributary to Allen creek and Irondequoit river. Owing to complaints received from riparian owners along these streams, the washings from the floors of the soap factory and the drainage from the pumping station are to be diverted to the pumping station and discharged with the sewage into the east side trunk sewer.

The sewage from the Lake farm was discharged by gravity flow directly into Lake Ontario. The end of the pipe, which is below the low water mark of the lake, is protected by a concrete bulkhead. The point of discharge of this sewer is in a cove some 400 feet north of another cove used as the bathing beach. It was found that this sewer, which was constructed last year, was also installed without the approval of this Department. The discharge of untreated sewage into the lake should be discontinued, especially in view of the fact that the bathing beach of the farm is located comparatively close to the outlet. It is possible that owing to the sandy nature of the soil the sewage could be cared for by means of subsurface irrigation. Plans for the proper treatment of the sewage from the farm should be prepared and submitted to this Department for approval by the State Architect under and in accordance with section 14 of the Public Health Law.

Garbage disposal

The garbage from the hospital is placed in galvanized iron cans or in covered garbage wagons located in or near the kitchens. This garbage is removed daily and fed to the hogs owned by the institution. Any excess garbage is treated with lime and hauled to a compost heap located about one-quarter mile from the main group of buildings.

Heating and ventilation

The institution is heated from the central power plant containing eight 150 horsepower horizontal tubular boilers. Both the direct and indirect systems of heating are used, and it was stated that the heating system was adequate to properly heat the institution, except in certain of the more exposed wards, during extremely cold and windy weather. At such times the patients in the improperly heated wards were placed in other wards which are sufficiently heated.

The fresh air inlets take the air from the outside of the buildings. In the indirect system of heating only natural draft is used, except in one or two

wards where it is necessary to force the air into the buildings. The ventilation is, of course, supplemented by windows. A serious condition regarding ventilation exists, however, by reason of the overcrowding of most of the wards, which results in insufficient floor and air space. Some of the more serious conditions of overcrowding are indicated in the following table:

DORMITORY IN	Number of beds	Square feet of floor space	Cubic feet of air space
Ward 3	72	38	450
Ward 6	56	40	480
Ward 8	6	36	360
Ward 8	4	45	650
Ward 9	59	33	370
Ward 10	60	40	480
Ward 11	50	39	470
Ward 12	48	43	515
Ward 31	44	39	390
Ward 31	50	35	350
Ward 50	42	34	340
Ward 50	22	32	320
Ward 52	44	35	330
Ward 53	41	39	390

It will be noted from this table that in many instances the floor space is less than 40 square feet and the air space less than 400 cubic feet, and in one case the floor space is as low as 32 square feet, with the corresponding air space of only 320 cubic feet. In general the floor space should not be less than 50 square feet per bed, nor should the air space be less than 600 cubic feet per bed, even with adequate and satisfactory ventilating facilities. It was also found that in connection with most of the wards there are a number of single rooms occupied by two patients. These rooms vary in size from 8x12 feet by 10 feet to 9x12 feet by 12 feet and are too small to afford adequate ventilation for two persons.

Milk

Raw milk is used at the institution and the consumption amounts to about 1,000 quarts a day. The milk is delivered by the producer in cans and placed in tin coolers in the refrigerators. The cans are washed with hot water at the institution before they are returned to the dairy and the coolers are also washed every day. The farm is inspected by the steward at the institution two or three times a year. The milk is tested by the State Agricultural Department twice a month. The dairy producing the milk has a score of 28½ for equipment and 49 for method, a total of 77½.

Recommendations

In view of the above I would make the following recommendations:

1. With respect to the water supply,
   (a) That the casings of the driven wells at the institution not in use be hermetically sealed.
   (b) That the privy at the Smith farm be moved farther from the well and that the privy vault be cleaned and disinfected.

2. In view of the inadequacy of the plumbing fixtures in most of the wards of the institution and to their unsatisfactory type, especially in the Monroe group,
   (a) That additional fixtures be provided in all cases where needed, in accordance with the standards indicated in the table given in the body of the report.
   (b) That old and obsolete fixtures be replaced by fixtures of modern sanitary type.
   (c) That additional bathing facilities be provided throughout the wards.

3. With reference to sewerage,

(a) That the washings from the floors of the soap factory and the drainage from the power house at the hospital be removed from the stream and the drainage from these structures be discharged into the sewage pumping station.

(b) That the construction of the new sewage pumping station at the hospital and the construction of the sewer at the Lake farm without the approval of this Department are violations of section 14 of the Public Health Law and should not be repeated.

(c) That the disposal of the sewage at the Lake farm is inadequate and insanitary and that plans for the proper treatment of the sewage at the Lake farm be prepared and submitted to this Department for approval, as required by section 14 of the Public Health Law.

4. That the use of the common drinking cup throughout the institution be done away with as soon as possible.

5. That, in view of the overcrowded conditions at the institution, additional buildings or additional wards should be provided in order that all of the wards may have not less than 600 cubic feet of air space and not less than 50 square feet of floor space per bed.

6. That the manure at the main stables be placed in manure pits and that such manure pits be screened against flies.

7. That the carpenter shop and soap factory be abandoned and new buildings erected in their places as soon as possible.

Respectfully submitted,

THEODORE HORTON,
Chief Engineer

ABANY, N. Y., *March* 15, 1915

UTICA STATE HOSPITAL (Utica)

HERMANN M. BIGGS, M. D., *State Commissioner of Health:*

I beg to submit the following report on an investigation of the sanitary condition at Utica State Hospital at Utica. The institution was visited and inspected by Mr. C. M. Baker, assistant engineer, on February 19 and 20, 1915.

Location and general description

Location.— City of Utica, county of Oneida.
Certified capacity.— 1,321.
Present population.— Inmates 1,604; employes, 225; total, 1,829.
Area of grounds.— 1,402 acres.
Number of occupied buildings.— 22.
Site of institution.— The institution proper is situated in the western portion of the city of Utica, about one mile from the New York Central Railroad station. Approximately 1½ miles southwest of the institution proper is located a farm called Graycroft and about six miles northwest near Marcy is a tract of nearly 1,000 acres of land owned by the hospital which was formerly composed of several farms. The buildings at only three of these farms are now occupied, but the land is all being worked by the institution. A part of this land is situated on a plateau or ridge overlooking the Mohawk river valley, and it was the original plan to construct a new institution at this place. The drainage of the institution grounds appeared to be satisfactory.

Buildings

General description of buildings.—At the institution proper there are about 18 buildings which may be considered occupied. This includes the main building, infirmary and acute hospital, where the incoming patients are received; also 4 industrial buildings, 4 employes' quarters, an assembly hall, a kitchen and a power house. In addition to these there are some 23 other buildings, including barns, storehouses, etc., thus making a total of about 41 buildings at the institution proper. At the Graycroft farm there is one main building used as a ward for some 56 patients, also some 15 other necessary farm buildings, making a total of 16. At the other farms two buildings are occupied by patients and one by employes, in addition to which there are also several other farm buildings.

General physical and sanitary condition of buildings.—The State Hospital in Utica is the oldest State hospital for insane in the State, the first buildings having been constructed in 1840. While it is thus obvious that some of the buildings are not modern in structure and consequently are not as well adapted to the needs of the institution as more modern buildings would be, it is neverless apparent from the inspection that the buildings are all kept in a good state of repair, as no unsatisfactory conditions were found at the time of the inspection. The infirmary and acute hospital have been more recently constructed and appear to meet the needs of the institution very satisfactorily.

Water supply

The water supply for the institution proper and Graycroft farm was made the subject of a special investigation by this Department The report thereon under date of December 30, 1913, described the supply as follows:

"The hospital has its own water supply, which is derived from a well and ground water infiltration gallery located about 1½ miles southwest of the institution in a sand and gravel plain. The well is 40 feet square and 10 feet deep and is covered by a small brick house. From this well the gallery extends 540 feet southwest and at the southern end of this gallery is a cross gallery 40 feet long. The well is built of loosely laid stone and is covered with stone flags. The gallery is 2 feet wide and 5 feet deep, the walls are of brick and the bottom of flags. In the walls numerous bricks are left out in order to facilitate the infiltration of the ground water. The entire gallery is covered with soil, and manholes with solid iron covers are provided every 100 feet. A 10-inch cast iron pipe runs from the well to the hospital.

"The water is pumped to the distribution pipe at the institution by two Wheeler duplex horizontal pioneer pumps (14x12 inches by 12 inches). The distribution system is connected with a tank on a tower 100 feet high in order to maintain a constant pressure. One pump operates continuously night and day, the other being held in reserve. These pumps are located in the power house at the hospital. The suction lift is about 6 feet and the average head against which pumping takes place is 50 pounds.

"The water supply on account of its scale forming quality is not used for boiler feed and a supplementary supply for the boilers is derived from rain water cisterns and from a small surface pond. To provide for emergency the hospital is connected with the public water supply system of Utica. When this supply has been used, in times of repair to the hospital water system, the cost has amounted to $50,000 a day. The water consumption is estimated at 300,000 gallons daily, or about 150 gallons per capita."

The area of the surface watershed tributary to the water supply is about 2½ square miles. However, in view of the large supply that is derived from this source, it is apparent that the water finds its way to the gallery from some other source than the watershed directly tributary to it. The institution owns about 20 acres of land in the vicinity of the well and collecting gallery. Recently adjoining land has been purchased by Italians, who have built some 15 or 20 shacks within a radius of 700 or 800 feet of the well, some of the buildings being located only about 150 feet distant. These buildings have no sanitary conveniences and all wastes are thrown upon the surface of

the ground. It is because of these settlements that the investigation previously mentioned was taken up, and the report discusses in detail the conditions surrounding the supply.

Each of the farms located at Marcy northwest of the institution are provided with separate water supplies. Woodside farm, where there are some 30 or 35 people, obtains its supply from a well located in a part of the building adjacent to the toilet and the sewer passes within about 12 feet of the well. This supply, however, has been insufficient for the needs of the farm and provision is now made for drilling a new well. Overlee farm, where there are some 15 or 20 people, receives its water supply from three springs located on the slope just below the farm buildings. One of the springs is located so that the drainage from the buildings cannot reach it directly, but the other two are just below the barn and barnyard, and it is quite possible for them to receive both surface and subsurface drainage from these places. The water flows from the springs to a small reservoir, thence to a hydraulic ram which forces it into the buildings. The other farm, occupied by a teamster, is supplied in a similar manner from one spring, which, however, is better located, so there is little opportunity for contamination. Samples were taken of all but the latter supply and sent to the Division of Laboratories and Research for analysis, the results, together with those of other previous analyses, being recorded in the following table:

DATE	Nitrogen as				Oxygen consumed	Chlorine	Total hardness	Alkalinity	Bacteria	B. Coli		
	Free ammonia	Albuminoid ammonia	Nitrites	Nitrates						10 c.	1 c. c.	1-10 c. c.
MAIN INSTITUTION SUPPLY												
February 7, 1911......	.010	.054	.001	1.60	0.90	6.00	171.4	171.0	30	+	—	—
May 6, 1912..........	.002	.012	.001	1.60	0.40	5.25	188.0	173.0	850*	—	—	—
December 11, 1913 ..	.004	.008	.001	1.70	0.90	6.50	221.5	193.0	55	+	—	—
February 19, 1914.....	.008	.012	.001	1.60	1.50	6.25	175.5	150.0	60	—	—	—
WELL AT WOODSIDE FARM												
February 19, 1914...	.030	.010	.001	3.20	1.10	6.50	26.00	5.00	75	+	+	—
COLLECTING RESERVOIR, OVERLEE FARM												
February 19, 1914.....	.....	.....	.....	.....	.....	.....	.....	.....	85	+	—	—

* Samples were two days in transit, which may account for large number of bacteria.

The results of the analysis of the sample of water taken from the main supply at the time of this inspection correspond very closely with those of other previous analyses, and therefore the following discussion of the character of the water quoted from the report of the previous investigation applies also to present conditions:

"The results of the analyses show decidedly the hardness of the water. The figures indicate little active or recent pollution, as will be seen from the figures for nitrogen in its various stages of oxidation, but that there has been considerable past pollution is shown by the large amount of oxidized nitrogen in the form of nitrates and the high figure for chlorine. The bacterial counts are reasonably low, but the occasional presence of organisms of the B. coli type in small quantities renders the absolute freedom of the water from harmful contamination somewhat doubtful. Analyses show only the condition of the water at the time the samples are taken and cannot show the condition at other times under different hydrostatic conditions of the ground water. Were samples taken after heavy rains while the supply is slightly turbid the

presence of active contamination would probably be found. While all contamination in this water may be thoroughly purified the greater part of the time, it cannot be said that this occurs at all times."

As a result of this previous investigation the following conclusions were drawn regarding the condition of the main water supply:

"1. That the water supply is subject to considerable past contamination, on the whole well oxidized and purified, but at times this contamination becomes somewhat active.

"2. That the gradual extension of the city in the neighborhood of the well will increase this contamination and eventually necessitate the abandonment of this supply.

"3. That the location of small dwellings, without sanitary conveniences and with a careless type of inhabitants, in the neighborhood, constitutes a menace to the purity of the supply.

"4. That the scale-forming properties of this water render it objectionable and uneconomical for laundry and hot water purposes."

The following recommendations, none of which have been carried out, were also made at that time:

"1. That in view of the doubtful sanitary quality of the water as shown by laboratory analyses and the possibilities for contamination as shown by the inspection, and also in view of the unsatisfactory quality of the water from the standpoint of hardness, the hospital authorities consider at once the securing of a new supply of satisfactory purity and softness.

"2. That, pending a new supply, every precaution be taken to prevent accidental or wilful pollution of the well by adequately fencing off the property upon which the well is located and by prohibiting trespassing and strictly enforcing such a prohibition.

"3. That the hospital authorities keep a close watch upon the sanitary conditions around the shacks in the neighborhood of the well in order that a proper sanitary disposal of excretal matters shall be carried out."

It appears from the information available that the simplest and most satisfactory solution of the problem will probably be for the hospital to arrange to obtain their water from the city of Utica providing arrangements can be made whereby this can be done at a reasonable cost. This would provide a water for the hospital in which the hardness as measured in parts per million by weight would probably not exceed 50 instead of averaging 175, as it does in the present supply. This would undoubtedly cause a considerable saving — first, in the amount of soap used at the institution; second, in the operating expenses of the softening plant for the laundry water, and third, in the amount of repairs to the plumbing system, which have been necessary in the past because of the deposits forming in the hot water pipes. It would seem therefore that by taking into consideration these factors, in addition to the present cost to the hospital of pumping its water and other various minor expenses, a rate could be obtained making it economical for the hospital to purchase its water supply from the city of Utica.

The results of the analyses of the water from the well at Woodside farm show a relatively high figure for free ammonia, very high nitrates and chlorine, and although the total number of bacteria were not excessive, the B. coli type were found present in quantities as small as 1 c. c. In view of this fact and also the unsatisfactory location of the well, this water cannot be considered as a safe supply, and consequently water from another source and satisfactory in quality should be obtained as soon as possible.

The bacterial analyses of the spring water at the Overlee farm show the presence of the B. coli type in 10 c. c. samples. In view of these analyses and also the unsatisfactory location just below the barnyard of two of the three springs, it would seem advisable to abandon these two and, if necessary, provide the additional supply needed by developing other springs located where they are not subject to contamination.

Plumbing

The plumbing is of the open type. The main drains are provided with house traps and fresh air inlets. The branch soil and waste pipes are also

properly vented. The plumbing has all been renewed within the last 15 or 16 years, and in general it appeared to be in very good condition. However, there has been considerable trouble with the hot water pipes because of the hard water forming a deposit on the inside and in some cases eventually entirely filling the pipe. The inspector was shown several sections of pipe which had been taken from the system in various places and were, in some cases, entirely filled with a hard crystaline, brownish deposit, while others were nearly filled. One of these sections which was filled, except for a very small opening, was from a pipe 4 inches in diameter. This deposit also causes considerable trouble with the valves of the hot water lines. These conditions necessitate constant repair in the hot water plumbing system.

The number of fixtures appeared to be somewhat insufficient in some cases. However, this condition is apparently due to the overcrowding of the wards, a subject to be discussed later, rather than a lack of a sufficient number of fixtures for the actual capacity of the wards. Drinking water is obtained in general from coolers by means of a common cup. Although this is a matter somewhat difficult to control in an institution of this character, it would seem that the use of the common drinking cup could be eliminated by providing some satisfactory type of drinking fountains.

Sewerage and sewage disposal

A combined system of sewers collects both the domestic sewage and storm water and discharges them into the Mohawk river without treatment. The pipes range in diameter from 6 inches to 2 feet. Although there are occasional stoppages from rags and similar material flushed into the sewers by patients, the slopes of the sewers appeared to be satisfactory. The trunk or outfall sewer is built of stone and is rectangular in sections, the size being 2x2½ feet. Manholes are apparently satisfactorily provided.

The practice of discharging the sewage from the hospital into the Mohawk river without treatment and thus polluting the waters of the river is objectionable from a sanitary and hygienic standpoint, and consequently steps should be taken by the hospital authorities as soon as practicable to provide suitable disposal.

Sewers are provided at the Graycroft, Woodside and Overlee farms, but in all cases they discharge practically on the surface of the ground without treatment At Graycroft the sewage is discharged into a dry drain 700 or 800 feet from the building, which eventually drains into the old abandoned Chenango canal. At Woodside and Overlee the sewage is discharged onto a slope below the buildings, which drains into the barge canal. The point of discharge is about 500 or 600 feet from the buildings at Overlee and 1,000 to 1,200 feet at Woodside. So far as could be determined by the inspector these sewer systems at the farms were constructed by the hospital without plans. In any event, there is no record of plans and specifications having been approved by the Department of Health, as is required by law. The discharge of sewage on the surface of the ground without any preliminary treatment must necessarily cause insanitary conditions, especially during certain seasons of the year, and therefore suitable disposal should also be provided at these places.

Garbage disposal

The kitchen garbage is collected daily, hauled to the piggery and fed to pigs. A great deal of the refuse is burned at an incinerator. The ashes and other similar material is used for filling in low ground.

Heating and ventilation

Heating.— The buildings are heated principally by the indirect system of radiation, although the direct system is used in some places. The heat for the institution proper is furnished by steam supplied from a central plant.

The farms are equipped with heating plants in the basement of the buildings. So far as could be determined by the inspector the heating facilities are satisfactory, no criticisms being offered by the institutional authorities.

Ventilation.— In connection with the heating, fresh air is taken from outside the buildings in all cases and in the older buildings fans are provided to force the air through the conduits, but in the others natural circulation is depended upon. Conduits leading from the wards to the roof remove the foul air. It is evident that the facilities for ventilation in the various wards at the institution are satisfactory, but the amusement hall, with a capacity of about 450, appears to be unsatisfactorily ventilated, the inspector being informed that during entertainments the air often became foul in it.

A great many of the wards and, in fact, the institution as a whole, is overcrowded, thus causing insufficient air and floor space in the wards. This unsatisfactory condition is indicated by the following table, showing the floor and air space on a number of the wards. It has not been attempted to make this record complete, but the data is given simply to indicate the general conditions:

LOCATION	Number of beds	Square feet of floor space	Cubic feet of air space	Class of patients
Dormitory in Ward 2..	10	35	385	Parole
Dormitory in Ward 5..	24	36	396	Aged and uncleanly patients
Dormitory in Ward 10..	9	28	382	Semi-disturbed patients
Dormitory in Ward 10..	18	33	462	Semi-disturbed patients
Dormitory in Ward 10..	9	36	504	Semi-disturbed patients
Dormitory in Ward 11..	4	40	440	Chronic
Dormitory in Ward 11..	17	32	352	Chronic
Dormitory in Ward 14..	85	41	574	Demented and uncleanly patients
Dormitory in Ward 20..	14	34	476	Disturbed and uncleanly patients
Dormitory in Ward 24..	14	34	476	Disturbed patients
Dormitory in Ward 26..	9	37	660	Epileptic patients

The floor space in none of the dormitories should be less than 50 square feet nor the air space less than 600 cubic feet per bed, in addition to which suitable day room space should also be provided. These figures should be correspondingly increased for sick wards, wards for the uncleanly patients or where the ventilation facilities are inadequate. The space in all of the dormitories listed above falls below this requirement, and it is noticeable that in a majority of the cases these wards accommodate the lower grade of patients, who are generally uncleanly.

The certified capacity of the institution is 1,321, but this figure does not include the capacity of the buildings at the Marcy farm, which is about 40, thus making the total capacity of the institution about 1,361. The number of patients present at the time of the inspection was 1,604, an excess of 243, or approximately 18 per cent. over the capacity of the institution. It is evident from the above that more room should be provided to satisfactorily care for the present number of patients.

Milk supply

The milk supply for the institution is furnished from the institution herd maintained at Graycroft farm, except that a few milch cows are kept at the other farms to furnish the supply necessary for the patients being kept at these places. The herd was tested for tuberculosis by a representative of the State Department of Agriculture about a month before our inspection, as a result of which a number of the cows were condemned and were being disposed of. Similar tests have been frequently made in the past, and it is the aim of the institutional authorities to keep the herd tubercular free.

The cow barn is provided with a concrete floor and appeared to be satisfactorily ventilated and also in satisfactory condition at the time of the

inspection. The milk house is equipped with a concrete floor and an aerator for cooling the milk, but is provided with neither hot water nor steam for sterilizing the aerator, milk pails or other utensils. The milk cans are washed at the kitchens at the institution proper, the pails at the farmhouse kitchen and the aerator at the milk house either with cold water or with hot water carried from the house. It would seem that more sanitary conditions could be maintained at the milk house and that there would be a greater assurance of the milk cans, pails and other utensils being properly sterilized if hot water and a steam sterilizer were provided for this purpose at the milk house. The milk is delivered soon after milking to the various kitchens about the institution, where it is placed in coolers.

The milk for the Marcy farms is produced at the Woodside farm. The cow barn is not modern, no milk house is provided and, in fact, the general equipment seems to be quite deficient. Milk is furnished from here to some 40 or 50 people, and it would seem therefore that better facilities should be provided.

As a result of this investigation, the details of which are recorded in this report, I beg to submit the following conclusions and recommendations:

Conclusions and recommendations

1. That, in view of the unsatisfactory condition of the water supplies at the institution, as pointed out in the report of a previous investigation and also in this report,

   (a) The institutional authorities immediately proceed with the arrangements necessary to obtain a satisfactory supply of water at the institution proper and that the use of the present supply be discontinued.

   (b) The well furnishing the water at the Woodside farm be abandoned and another supply satisfactory in quality be provided.

   (c) The springs which are subject to contamination at the Overlee farm, descriptions of which are given in the body of this report, be abandoned and another supply not subject to contamination provided instead, if necessary.

2. That in regard to sewage disposal,

   (a) The hospital authorities consider, as soon as practicable, a method of treatment for the sewage from the institution proper, plans for which should be submitted to this Department for approval.

   (b) Suitable disposals be provided at the various farms conducted by the institution, plans for which should be submitted to the Department of Health for approval.

3. That, in view of certain deficiencies in the ventilating facilities and the general overcrowding in the institution,

   (a) Better ventilation be provided in the amusement hall.

   (b) More room be provided for ward space, either by providing new buildings or additions to the present ones, unless the number of patients at the institution can be reduced so as to eliminate the overcrowding.

4. That, to assure a more satisfactory milk supply;

   (a) Hot water and a steam sterilizer be provided in the milk house at Graycroft farm in order that the milk pails, cans and other utensils may be satisfactorily sterilized.

   (b) Better facilities be provided at the Marcy farms so that the milk supplied there may be produced under more sanitary conditions.

Respectfully submitted,

THEODORE HORTON,
Chief Engineer

Albany, N. Y., *March* 5, 1915

MOHANSIC STATE HOSPITAL (Yorktown)

HERMANN M. BIGGS, M.D., *State Commissioner of Health:*

I beg to submit the following report on an investigation of the sanitary condition of the Mohansic State Hospital at Yorktown. This institution was visited and inspected by Mr. C. M. Baker, assistant engineer, on March 17, 1915:

Location and general description

Location.— Town of Yorktown, county of Westchester

Certified capacity.— 54 inmates

Present population.— Inmates, 65; employes, 31; total, 96

Area of grounds.— 602 acres

Number of occupied buildings.— 8

Class of inmates.— The inmates are composed of the better class of insane, that is, those who are able, mentally and physically, to work. They are not committed directly to this institution, but are transferred from some of the other State hospitals.

Site of institution.— The Mohansic State Hospital is situated just to the north of Mohansic lake, in Westchester county, about 36 miles from New York, 6½ miles from Peekskill and 2½ miles northwest of Yorktown Heights. The contour of the country is somewhat irregular, but in general appears to be satisfactorily drained, especially in the locality of the buildings. It is planned to construct a new institution at this place, and it is apparent that the location is very satisfactory for this purpose.

Buildings

General description of buildings.— The present buildings of the institution are composed of seven groups of old farm buildings. At the Menges farm are the officers' and superintendent's quarters; at Purdy, Gross and Strang farms are quarters for inmates; at Biederhase and Morton farms, employes quarters, and at Johnson farm are the storehouse and quarters for two employes. The principal barns where stock are kept are at Menges, Johnson and Strang farms. The laundry is located at the Purdy farm.

General physical and sanitary condition of buildings.— Although some repairs have been made to the buildings, it may be generally stated that with the exception of the buildings at Menges and Biederhase farms and the laundry located at the Purdy farm, they were in an unsatisfactory condition. The floors in most cases were rough and badly worn, making it difficult to keep them in a satisfactory sanitary condition. The condition of the cow barns at the institution was especially unsatisfactory, a matter which, however, will be taken up more in detail later. It is evident from the above that either new buildings are needed or that extensive repairs are needed in the old ones, if the use of them is to be continued.

As stated above, it is planned to construct a new hospital at this place for the purpose of relieving the overcrowded conditions now existing in the State hospitals in the metropolitan district, a condition which has been pointed out in detail in the reports on investigations recently made of those institutions. In fact, the investigations of the other State hospitals have indicated that they are all somewhat overcrowded, but it is also evident that the conditions are most severe in those located near and receiving patients from New York city and vicinity. In view of this fact it would seem advisable for the proper authorities to push to completion, as soon as possible, the plans of developing a new institution at Mohansic, not only to relieve the unsatisfactory condition now existing there, but also to relieve the overcrowded conditions in the other State hospitals.

Water supply

The present water supply for the institution is derived both from Mohansic lake and from wells. The three farms, Biederhase, Gross and Purdy, are supplied with water directly from Mohansic lake without purification. The intake extends about 35 feet into the lake, where the depth of water is about 20 feet, and is located just below the Gross farm. The water is pumped from the lake by means of a gas engine to a standpipe located just back of the laundry at the Purdy farm.

Strang farm is supplied from a well or spring located at the upper side of pasture about 300 feet from the buildings. The well is walled up with loose stone and is about 8 feet in diameter. The water rises to within about 4 feet of the surface of the ground and is about 4 feet deep in the well. The well is enclosed by a wire fence to keep stock from its immediate vicinity, but the fence was in need of repair at the time of the inspection, and it is apparent that too small an area is enclosed, the fence passing within one foot of the edge of the well. It would also seem that ditches should be provided to divert surface drainage from the well. The well is covered by a board platform provided with a manhole for inspection and cleaning. A small pump house nearby is equipped with a gas engine which pumps the water to a standpipe located near the farm buildings.

A well similarly constructed supplies the water for the Menges farm. It is located in a small valley through which there was a small stream of water flowing at the time of the inspection, but the inspector was informed that it is dry during the summer months. About 300 feet above the well are located several buildings, two or three barns being located so that the drainage from them finds its way directly into the brook. It is quite probable that this well is supplied by means of seepage from the brook, and in view of this fact it would seem quite possible for it to receive pollution from the vicinity of the buildings located above. These, however, are located on the Croton watershed, in consequence of which the buildings are regularly inspected, and the sewage from them is evidently being properly cared for.

A well equipped with an iron pump and covered with a wooden platform furnishes the supply at Johnson farm. It is located comparatively near the house, but is so situated that it does not receive the drainage from the buildings, and it is apparent that it should furnish a satisfactory supply of water. A well similarly constructed supplies the Horton farm, but the pump was operating very unsatisfactorily at the time of the inspection, it being necessary to prime it and also very difficult to get water from it at all.

Plans for developing the water supply in connection with the new hospital to be constructed were approved in 1912 (Vol. 33, page 601 of the annual report). They provide for purification of the Mohansic lake water by means of sedimentation, aeration and slow sand filters. Raw water is to be used for fire protection and irrigation. However, nothing has yet been done in the way of developing this project.

Samples were taken of each of the water supplies except at the Johnson farm and sent to the Division of Laboratories and Research for analyses. The results, together with those of other previous analyses, are recorded in the following table:

DATE	NITROGEN AS				Oxygen consumed	Chlorine	Total hardness	Alkalinity	Bacteria	B. COLI		
	Free ammonia	Albuminoid ammonia	Nitrites	Nitrates						10 c. c.	1 c. c.	1-10 c. c.
MOHANSIC LAKE SUPPLY												
September 27, 1910	.085	.374	Trace	0.02	4.81	2.50	32.5	32.0	330	+	+	−
March 17, 1915	.016	.155	.002	0.16	7.60	3.25	29.90	29.0	110	+	−	−
STRANG FARM — WELL												
May 11, 1911	.012	.030	.010	1.60	0.20	3.00	32.5	21.0	8,000	+	−	−
March 17, 1915	......	......	......	......	......	......	......	......	150	+	−	−
MENGES FARM — WELL												
May 11, 1911	.054	.052	.014	0.80	0.30	4.00	51.4	37.0	600	+	−	−
March 17, 1915	.006	.018	.002	4.00	2.50	2.00	61.4	45.0	170	+	+	−
HORTON FARM — WELL												
March 17, 1915	......	......	......	......	......	......	......	......	450	−	−	−

From a study of the character of the water supplies and the results of the analyses of the water from them it is apparent that none of them are satisfactory, with the possible exception of the well at the Johnson farm, from which, however, samples were not taken, and the well at the Horton farm. The presence of bacteria of the B. coli type and the comparatively high figures for free and albuminoid ammonia indicate active contamination of the lake supply. Similar pollution, although not so pronounced, is also indicated in the water from the Strang farm well. However, it is apparent that if this well were properly protected by enclosing a sufficient area surrounding it with a suitable fence and providing drainage ditches to divert the surface wash, a satisfactory supply could be developed. The dwellings located in the small valley or depression above the Menges farm well are a menace to its present water supply, as is borne out by high nitrates and the presence of the B. coli type of bacteria in quantities as small as 1 c. c., indicated by the analyses of the sample taken at the time of the inspection. Although the bacterial analysis of the sample taken from the well at the Horton farm indicates a rather high bacterial count, they may be due to the necessity of priming the pump and the difficulty of flushing the pipes out sufficiently afterwards because of the unsatisfactory condition of the pump It is quite probable that if this pump were properly repaired and sufficient care taken to prevent surface wash, or drainage through the platform, back into the well, the supply would be satisfactory.

An order has been issued by the institutional authorities to boil all drinking water, and the wisdom of this act is shown by the facts mentioned above. The institution is now investigating other sources of water supplies with the view of developing a sufficient and satisfactory supply for future use. Until this new supply is ready for use the institutional authorities should protect the present supplies from pollution as far as practicable, i. e., by protecting and repairing the wells as indicated above, and furthermore, the practice of boiling all water used for culinary and drinking purposes should be rigidly enforced.

Plumbing

The plumbing at the institution has been recently installed under the direction of the State Architect. It is of the open type; the main drains are satisfactorily provided with house traps and fresh air inlets, and it is apparent that the facilities are satisfactory and adequate for the present needs of the institution.

Sewerage and sewage disposal

The sewage at the various buildings is disposed of by means of cesspools and privies. At the Purdy farm the disposal consists of a cesspool with subsurface drains, there being a separate system for the domestic sewage and for the drainage from the sinks and baths. Biederhase has a similar disposal.

The drainage from the laundry at the Purdy farm discharges into a sand filter bed which is underdrained and appears to satisfactorily care for these wastes.

A privy is provided at the Johnson farm and is located back of the barn about 200 feet from the house and well. It has an earth vault, and appeared to be properly cleaned and maintained in fair condition.

While the present methods of sewage disposal at the institution cannot be considered entirely satisfactory, it is apparent that they meet the present needs of the institution. However, as the institution grows and more patients are to be cared for a more adequate system of disposal should be provided. This is a matter, however, which will doubtless be taken care of with the development of the new institution.

Garbage disposal

The garbage appears to be satisfactorily taken care of, the kitchen garbage being collected and fed to pigs and the other refuse either burned or used for filling in certain low places on the grounds.

Heating and ventilation

Heating.— With the exception of the houses at the Johnson and Horton farms, the buildings are equipped with steam heating plants which are located in the basements. It is apparent from the inspection that the heating facilities are satisfactory.

Ventilation.— The fresh air is admitted to the various buildings by means of the windows, which if properly regulated should furnish a satisfactory amount.

The dormitories for patients were generally overcrowded. At the Purdy farm one dormitory provides only 31 square feet of floor space and 248 cubic feet of air space and another only 39 square feet of floor space and 273 cubic feet of air space per bed. A small day room is provided on the first floor of this building but it is apparently insufficient in size for the 21 patients it must accommodate, in consequence of which the dormitories are doubtless also used to some extent as day rooms. The dormitories at the Cross and Strang farms are similarly overcrowded, one dormitory at the latter place allowing 36 square feet of floor space and 288 cubic feet of air space per bed. It was also observed that at this place no day room is provided. Although the patients at this institution are composed of the better class of insane — only those who are able both mentally and physically to work, being transferred to it — and are out of doors most of the time during the day, nevertheless suitable day room space should be provided for such time during the evening and day that they are confined within the buildings. It is objectionable in any case to use a room both as a dormitory and day room and this, especially in view of the fact that the dormitories are overcrowded. Not less than 50 square feet of floor space should be provided and 600 cubic feet of air space should be allowed per bed in all dormitories in addition to which suitable day room space should be provided. The certified capacity of the institution is 54 and the number of inmates present at the time of the inspection was 65, an excess of 11 or 20 per cent, which also indicates to some extent the overcrowded condition.

It is evident from the above that more room is needed at this institution in order to satisfactorily care for the present number of patients but this condition will doubtless be taken care of after the new institution is developed as planned.

Milk supply

The milk supply for the institution is furnished from two herds, one tubercular free and apparently healthy and the other a segregated herd. The milk from the latter herd is pasteurized and is used almost entirely by the inmates while that from the former is fed to calves.

The cow barn for the segregated herd is located at the Johnson farm. It is not modern and is unsatisfactory regarding air space, ventilation and general conditions. It, however, was found as clean as the conditions would permit. No milk house is provided. The milk is strained in the barn after which it is taken to the pasteurizer located at the Purdy farm. The facilities of this cow barn are entirely inadequate and unsatisfactory. The pasteurizer at Purdy farm is located in a building constructed of wood and provided with a wooden floor. Although well equipped with a steam sterilizer and efficient type pasteurizer, this building is unsatisfactory for the use being made of it. The inspector was informed that a new building has been requested and that if this request is not granted the present building is to be provided with a concrete floor.

The cow barn at the Strang farm for the tubercular free herd was old and in a very bad state of repair. The floors, which are of wood, were broken through in many places. The barn is only about 7 feet high, allowing insufficent air space and the ventilation is unsatisfactory, in fact, the conditions were such that it would seem difficult to maintain a herd in satisfactory health under such conditions. The barn was as well cleaned as the conditions of the floors and structures would permit. No milk house or satisfactory equipment for handling the milk was provided.

It is evident from the above that the present methods of producing the milk supplies at the institution are very unsatisfactory, and furthermore the practice of using the milk from the segregated herd for the inmates and employes even though it be pasteurized, raises a question, because of the possibilities of ineffective operation of the pasteurizer. In view of these possibilities it seems expedient to emphasize the necessity of very careful supervision and operation of the method and process of pasteurization, in order that effective results may be obtained at all times. Even this, however, will not eliminate the necessity of providing suitable equipment and producing all milk under sanitary conditions, but it would seem that with such facilities provided, and with efficient pasteurization of the milk from the tubercular herd, this milk might be safely used by the inmates and employes. A new cow barn, modern in type and properly equipped, is much needed at this institution and until such a barn is provided — or until the present structures undergo very extensive repairs, the economy of which is rather doubtful — it will be difficult if not impossible to produce the milk for the institution under satisfactory conditions. In the meantime it would seem advisable to pasteurize all milk used by the inmates and employes whether from the tubercular free or the segregated herds.

As a result of this investigation it is evident that certain sanitary improvements are very much needed at the Mohansic State Hospital and I therefore beg to submit the following conclusions and recommendations:

Conclusions and recommendations

1. In view of the unsatisfactory and overcrowded condition of the buildings at this institution and also of the excessive overcrowding of the State hospitals in the metropolitan district I would recommend that:

   (a) The plans for constructing a new hospital at this place to relieve these conditions be completed as soon as possible.

   (b) To provide satisfactory quarters for the present inmates in the meantime, suitable repairs, as indicated in the body of this report, be made to the present buildings without delay and that more room be provided if the present number of patients are to be maintained.

2. That, in view of the present unsatisfactory condition of the water supplies,

   (a) A suitable fence enclosing a sufficient area about the Strang farm well be provided to prevent contamination from stock in the pasture, and that drainage ditches be properly constructed to divert the surface wash from the well.

   (b) The pump at the Horton farm be repaired.

   (c) Pending the development of a new and satisfactory supply which should be accomplished as soon as possible, the practice of boiling all water used for drinking and culinary purposes be rigidly enforced.

3. That, in view of the unsatisfactory condition of the milk supplies at the institution as pointed out in detail in this report,

   (a) A new cow barn, modern in type and properly equipped be provided, or, that the present barn be extensively repaired and remodeled so that they will conform with modern practice and that all milk be produced under sanitary conditions, as soon as possible.

   (b) Very careful supervision be maintained at all times to assure effective pasteurization of the milk and that pending the above improvements all milk used by the inmates and employes be pasteurized whether from the tubercular free or the segregated herd.

Respectfully submitted,

THEODORE HORTON,
Chief Engineer

ALBANY, N. Y., *April* 9, 1915

PRISONS AND HOSPITALS FOR INSANE CRIMINALS

Auburn State Prison (Auburn)

HERMANN M. BIGGS, M. D., *State Commissioner of Health:*

I beg to submit the following report on an investigation of the sanitary condition of the Auburn State Prison at Auburn. This institution was inspected by Mr. C. M. Baker, assistant engineer, on January 29–30, 1915.

Location and general description

Location.— City of Auburn, county of Cayuga

Capacity.— 1,284 men; 150 women; total 1,434

Present population.— Inmates, 1,384 men; 110 women; attendants, 138 men; 8 women; total population 1,640

Class of inmates.— Convicts

Area of grounds.—3.5 acres

Number of occupied buildings.—18

Site of institution.— The institution is situated near the center of the city of Auburn, on the Owasco river. The east gate of the prison is just across the street from the N. Y. C. & H. R. R. station.

Buildings

General description of buildings.— All the buildings are enclosed within a stone wall and those for men and women are located in separate yards. The women's division is composed of a main building constructed in the form of the letter "L" and subdivided into three parts, each of which is two stories high and contains two wards. This group also includes a kitchen, laundry and boiler house. In the men's division are the offices, two cell blocks and an isolation cell house, seven or eight large industrial buildings and other small accessory buildings.

General physical and sanitary condition of buildings.—Auburn Prison is nearly 100 years old and, although it is apparent that generally the buildings have been kept in a fair state of repair, some of them are not in an entirely satisfactory condition. In the prison for men the floors were in an unsatisfactory condition in some cases, especially in the kitchen, laundry and bucket house. In the laundry and the industrial room known as the Upper School Furniture Shop, the ceilings were warped and decaying; in the former building probably due to steam from the washers and in the latter caused by leaks in the roof. The hospital was being remodeled and repaired at the time of the inspection and will doubtless be in very good condition when the work is completed.

In the women's prison the most unsatisfactory condition was in regard to the floors. They are old and badly worn in all the wards. In some cases there are cracks nearly ½-inch wide between the boards and in a few places the boards on the first floor are worn through to the second or rough floor. Although these floors appear to be well cleaned, it is impracticable to maintain them in a satisfactory and sanitary condition. Many of the tiles in the kitchen floor were broken. The floor of the laundry which is of brick was rough and broken in places. The ceiling in this building was decaying and in an insanitary condition.

It is evident from the above that repairs are needed in many places throughout the institution.

Water supply

The domestic supply is obtained from the mains of the city of Auburn through an 8-inch cast-iron pipe. The distributing system consists of 6 and 8-inch mains with the circuits incomplete, thus leaving a number of "dead

ends." The source of the Auburn water supply is Owasco lake. The watershed is protected by rules enacted by this Department which are evidently being enforced. Samples of the water were taken for analysis by the Division of Laboratories and Research and the results indicate what is generally known from previous analysis of this supply, that the quality of this water is generally satisfactory. This supply is sterilized with liquid chlorine.

A second supply of water is derived from the Owasco river by pumping from the river to a standpipe. This supply is used only in the boilers and closets and for sprinkling purposes. So far as could be learned by the inspector no faucets are connected with this supply from which drinking water might be obtained except, possibly, the faucets on the grounds to which the hose is attached for sprinkling. There is a cross connection between the two supplies provided with a valve. The pressure of the city supply, however, is greater than that of the creek supply, and if there were a leak in the valve, or if the valve were opened, the flow would be from the city supply into the mains of the river supply. The supply from the river is known to be polluted and unsafe for domestic use, but it is evident that, with the precautions taken at the institution, and in view of the fact that there are no faucets connected with this supply, there is little opportunity for danger from the use of this water for drinking purposes.

Plumbing

General type.— Both the open and closed types of plumbing are in use at the institution. Many of the fixtures and much of the plumbing system is of an obsolete and insanitary type. In a number of cases fresh air inlets and vents are not provided. The system is old and has been added to from time to time with improper attention to the renewal of the old piping and sanitary requirements, causing in some cases insanitary conditions. Some of the pipes are insufficient in size, there being two or three vents in the women's division only 1¼ inches in diameter, resulting in their becoming "frost choked" in the winter. It is quite evident that a large part of the plumbing is old and deteriorated, and consequently in need of renewal or repairs.

Condition of fixtures.—The majority of the hoppers of the toilets in the women's division are connected to the pipe leading from the flush tank by means of rubber hose, necessitating frequent changes and often resulting in leaks. The fixtures are in some cases of an obsolete and insanitary type and in many of the shops are insufficient in number. No plumbing is provided in the cells except in the condemned cells. A toilet containing a flush closet, however, is located in the corridor of each of the cell blocks for the use of the prisoners. The pail system is in vogue for removing the waste from the cells. The following table illustrates the inadequacy of the plumbing fixtures, the first column giving the location, the second the number of people served and under the different types of fixtures are given the present number and, for comparison, the number that should be provided:

LOCATION	Number served	TOILET SEATS		URINALS		Remarks
		Present Number	Required Number	Present Number	Required Number	
Chair shop	79	2	5	1	2	
Machine shop	75	2	6	1	2	Old type hoppers
Weave shop	85	1	6	1	2	
Cloth shop No. 2	35	1	2	1	1	Booth not vented
Lower cabinet shop	75	2	5	1	2	Booth not vented
Lower school furniture shop	84	2	6	1	2	Booth not vented

The table indicates that in many cases only about one-half of the required number of fixtures are provided. The only lavatory fixtures in the shops are old wooden sinks which are equipped with an insufficient number of faucets for the number of people accommodated. Better toilet and lavatory facilities

should be provided in nearly all the shops, and it would seem that this need should be especially emphasized in view of the fact that no washing or toilet facilities are provided in the cells. The warden of the prison has previously recommended that the old cell blocks be replaced with modern steel ones and that these be equipped with a closet and lavatory bowl. This change would certainly greatly improve the sanitary conditions and should therefore be given careful consideration.

The bath house for men is equipped with 34 showers, enclosed in booths, and two tubs. In addition to these, shower baths are provided in the foundry for those working there and tubs are provided at the hospital. Tub baths are provided in the women's division and were satisfactory except that in Ward No. 2 the tub is old, the enamel is scaled off in places and, in fact, the tub is in an insanitary condition and should be replaced by another of a satisfactory type.

Sewerage and sewage disposal

Plans were provided for intercepting sewers and a pumping station to collect the sewage from the prison and discharge into a section of the city sewer system and were approved by the Department in 1910 (volume 31, page 382 of the annual report, Department of Health) on condition that "no storm or surface water from grounds, roofs or other areas shall be admitted to the sanitary intercepting sewers or pump well." This system has been only partly completed, the sewers from the women's division not yet having been connected with the system. Consequently this sewage is still discharging without treatment into the Owasco river. The pumps as originally installed were found unsatisfactory, and consequently were not approved by the State Architect. Recently, however, the contractor has installed new pumps which have subsequently been approved and are apparently operating satisfactorily. The system of sewage disposal should be completed according to the approved plans without delay, and thus eliminate the discharge of untreated sewage into the Owasco river.

The "bucket house," where the contents from the pails from the cells are disposed of, is equipped with catch basins connected with the sewer system and running water for emptying and rinsing the pails. The catch basin where the pails are emptied is provided with a bar screen. Each prisoner takes his pail from the cell to the bucket house in the morning, where it is emptied, rinsed and set on a rack in the open air. Later in the day the pails are disinfected with creoline by men detailed to that work. The screenings from the bucket house and also from the screens at the pump station are disposed of with the garbage. Near each of these buildings was noticed a pile of this refuse which had been allowed to accumulate on the ground. It was apparent that the present method of disposing of the sewage screenings is unsatisfactory. Such wastes should in all cases be either burned or buried.

Sewage disposal

The kitchen garbage is sold to local parties, who feed it to pigs. It is collected daily. Other refuse is collected and taken to a dump outside the city. The method of garbage disposal appears to be satisfactory except for the practice of disposing of the sewage screenings in connection with the garbage, as described above.

Heating and ventilation

Heating.— Both the direct and indirect systems of heating are in use. Most of the buildings are heated with steam, although the hospital and the warden's house are heated by hot water. The inspector was informed that the boilers furnishing the heat for the institution are old and in an unsafe condition. In view of this fact the State Boiler Inspector has yearly cut down the allowable steam pressure.

Ventilation.— Unsatisfactory ventilation was noticeable in a number of the toilets and some of the industrial shops of the men's division, also in the

laundries and kitchens of each division. Some of the toilets in the industrial buildings are located in brick booths without ventilation except through the door leading into it. Others are in open booths located in the rooms used as shops, with the side partitions extending only 4 or 5 feet above the floor. In the former case the booths should be ventilated and in the latter case the partitions should be built higher and be provided with separate ventilators, carrying the foul air to the outside of the building. While the ventilation in a number of the industrial buildings was not entirely satisfactory, the most serious conditions were noticed in the Lower Cabinet and Lower School Furniture Shops and in the finishing room for wool goods located in the basement of one of the buildings. In the two former cases the work is naturally dusty and dirty and in most cases the lathes, saws and similar machines were either not equipped with vacuum conveyors to remove the dust and shavings or these devices were not in operation, thus resulting in unnecessary dust in the room. The condition of the air of these rooms at the time of the inspection was unsatisfactory. Doubtless if the machines were properly equipped with vacuum conveyors to remove the dust and dirt and if these conveyors were properly operated the conditions would be much improved. The laundries in both the men's and women's divisions are provided with low ceilings and are inadequately ventilated.

The ventilating hood over the cookers in the kitchen of the men's division is badly rusted, the pipe leading from it to the roof is rusted through in many places, causing not only objectionable gases and fumes but insufficient ventilation to remove the steam and other vapors from the room. Steam collects on the hood, condenses and at times drips back onto the food undergoing cooking. The kitchen at the women's division is provided with a low steel ceiling. The ventilation is insufficient, in consequence of which steam collects and condenses on the ceiling, causing the water to drip from it at times.

The auditorium, which is about 62x96 feet and 16 feet high, accommodates all the men of the prison, or about 1,300 in all. This allows only approximately 75 cubic feet of air space per person. The room is provided with no ventilation except from the windows, and the inspector was informed that after being occupied for a short time the air becomes very foul. Some form of positive ventilation should be provided in this room in order to maintain the air in a satisfactory sanitary condition.

A dormitory known as the old hospital located at the top of one of the cell blocks provides accommodations for some 50 men. The room is only about 44 feet square and 10 feet high. This allows an air space of only about 390 cubic feet per person, when not less than 500 should be provided.

It is quite evident from the above that better ventilation should be provided in many places throughout the institution.

Milk

The milk supply is obtained from a dealer in the city of Auburn and is under the control and supervision of the local Board of Health. The health officer informed the inspector that a recent inspection of the dairies and equipment of this company had failed to reveal unsatisfactory conditions. The milk is pasteurized. Samples are sent semimonthly to the Department of Agriculture for analysis, the results of which indicate a milk of satisfactory physical quality. Analyses of this supply both physically and bacteriologically are also frequently made by the city bacteriologist. It is thus evident that proper precautions are being taken to protect the milk supply from possibilities of contamination.

Conclusions and recommendations

In view of certain insanitary conditions found at Auburn prison, as pointed out in detail above, I beg to submit the following recommendations:

1. That, owing to the unsatisfactory state of repairs of many of the buildings, especially in regard to the condition of floors and ceilings, these buildings be at once repaired and renovated and placed in a good and sanitary condition.

2. That, in view of the insanitary condition of the plumbing and inadequacy of fixtures in many cases.

(a) The plumbing system be generally repaired and renewed where necessary in order to eliminate all unsatisfactory joints and piping and put the system in a satisfactory sanitary condition.

(b) Where insufficient or unsatisfactory plumbing fixtures are provided, a sufficient number of sanitary fixtures be provided.

(c) The old, insanitary bath tub in Ward 2 be replaced by one of a modern type.

3. That in regard to sewage disposal,

(a) The sewer system of the women's division be connected with the general system as indicated by the plans previously approved by this Department.

(b) The present method of disposing of sewage screenings be discontinued and this refuse be either burned or buried and not allowed to accumulate.

4. That in view of the inadequate and unsatisfactory means of ventilation found in the toilets, shops, laundries, kitchens, auditorium and dormitories, as pointed out above in detail, proper methods and more adequate ventilation be in all cases provided.

Respectfully submitted,

THEODORE HORTON,
Chief Engineer

ALBANY, N. Y., *February* 2, 1915

Matteawan State Hospital (Beacon)

HERMANN M. BIGGS, M. D., *State Commissioner of Health:*

I beg to submit the following report on an investigation of the sanitary conditions of the Matteawan State Hospital at Beacon, Westchester county, made at your direction by Mr. C. A. Holmquist, assistant engineer of this Department, on January 22 and 23, 1915:

Location and general description

Location.— City of Beacon, Westchester county

Certified capacity.— 617 inmates

Present population.— Inmates, 820; attendants, 122; other employes, 70; total, 1,012

Class of inmates.— Criminal insane

Area of grounds.— 484 acres

Number of occupied buildings.— 7

Site of institution.— The main groups of buildings of the institution are situated on a hill at an elevation of about 320 feet above sea level and about 140 feet above the general level of the adjacent territory. The slopes of the grounds around the main groups of buildings are steep, affording adequate drainage.

Buildings

General description of buildings.— Of the seven occupied buildings, two are occupied by the patients and five by the employes and officers. The remainder of the buildings include a laundry, storage building, machine shop, boiler house, ice house, stables and barns.

General physical and sanitary condition of buildings.— The buildings occupied by the patients and officers and attendants are divided into two separate

groups known as the main group and the women's group and are admirably laid out with respect to lighting and ventilation.

The main group consists of the administration building and the hospital building connected by corridors, the laundry building, machine shop and boiler house. This group of buildings, together with the high board fence, forms a rectangular enclosure 510 feet wide by 550 feet long. Northeast of the main group of buildings is the women's building. Southwest of these groups of buildings are the cottages of the steward and the farmer, as well as the barns and stables belonging to the institution.

The main buildings are all constructed of brick and are two stories high, with cellars or basements underneath. The basements are provided with concrete floors and were found to be dry. They are in general used for the storage of materials as well as for carrying steam and ventilation pipes. In the women's building a portion of the basement is used as a temporary kitchen and dining room.

The stables of the institution appeared to be in a sanitary condition. The manure is removed from them daily and deposited on the farm land. The drainage of the stables and barns appeared to be satisfactory.

Water supply

The water supply of the institution is derived from five driven wells each about 300 feet deep. These wells were driven through a clayey soil to a depth of from 12 to 20 feet to rock. An 8-inch casing extends through the soil to rock at each well. Inside of this casing is a 3¾-inch air casing driven to a depth of 115 feet, which casing encloses a 2½-inch water pipe driven to a depth of 130 feet. The water is raised in the wells by air pressure and flows by gravity through 2½-inch pipes to a suction tank at the pumping station. This tank is of steel, 17 feet in diameter and 10 feet deep. From this tank the water is pumped by means of 7x8-inch triplex Gould pump having a capacity of 160 gallons per minute to two underground concrete reservoirs located on the institution grounds. These reservoirs, which have a capacity of about 250,000 gallons, are covered and provided with manholes extending above the surface of the ground. From the reservoirs the water is pumped to a standpipe 15 feet in diameter and 80 feet high. The standpipe and the reservoirs are provided with blow-off valves. The standpipe is blown off and cleaned once a year and the reservoirs are cleaned twice a year. The water consumption of the institution is about 100,000 gallons per day, equal to a daily per capita rate of 100 gallons.

Four of the wells are located from 300 to 500 feet from the barns and stables of the institution. The other well is located about 1,200 feet northwest of the main group of buildings and about 85 feet from the outfall sewer of the institution. No samples of the water from the wells were collected at the time of the inspection, but containers for the collection of such samples were subsequently sent to the institution. The results of the analyses given below indicate a very hard water. The relative high nitrites, nitrates and chlorine would show that organic matter introduced into the water in the past has been oxidized. The free ammonia is also somewhat high, but does not necessarily indicate active decomposition in the case of deep well supplies. The low bacterial count and the absence of bacteria of the coli type indicate that the water is free from active contamination and except for its hardness may be considered of a satisfactory quality for domestic use:

Nitrogen as —				Chlorine	Oxygen consumed	Total hardness	Alkalinity	Bacteria per c.c.	B. Coli type		
Free ammonia	Albuminoid ammonia	Nitrites	Nitrates						10 c.c.	1 c.c.	1-10 c.c.
.028	.002	.005	0.120	10.50	1.50	203.00	177.00	5	—	—	—

There is also a connection at the institution with the mains of the Beacon public water supply. This water is used only in case of emergency, and it was learned that it has been used on only two or three days during the past two years. The Beacon supply is of a fair sanitary quality and is not subject to pollution except during the summer from the summer cottages and hotel on Mt. Beacon. Water is also pumped from Fishkill creek by the city during times of shortage of the regular supply. On the advice of this Department the water is treated with liquid chlorine at such times.

Plumbing

Although the major portion of the plumbing in the main group of buildings is old, having been installed when the institution was constructed in 1890, it appeared to be in a satisfactory state of repair. Most of the original hopper closets have been removed and replaced with more modern enameled-ware types. The main drains are provided with house traps and fresh air inlets. The two-stack system is used in the main buildings and the soil stacks are connected in the attics above all fixtures, from which point a 6-inch pipe is carried through the roof from each group of fixtures. The fixtures in the women's group of buildings were installed within the last four years and are of modern type. The floor drains from the shower baths of these buildings discharge into separate pipes on the two-stack system. Two closets and a slop sink discharge into a branch soil pipe connected with a stack which is carried through the roof. The branch soil pipes, however, are not back-vented and the discharge of the closets is liable to siphon out the trap in the slop sink at the end of the line. One of the main drains in the infirmary has no fresh air inlet.

In general there is one bathroom containing a shower bath, a washroom with three long lavatories with two faucets each and a toilet room with four long closets for the day room of each of the large wards of the main building and a toilet room containing two closets and a slop sink for each of the dormitories.

All these rooms are well lighted and ventilated and the fixtures would be adequate for the needs of the institution if not crowded beyond its rated capacity. Although the lavatories in the main building are of cast iron, they appeared to be maintained in a sanitary condition. It probably would be better, however, to replace the iron lavatories with enameled-ware fixtures as soon as practicable, inasmuch as it would be easier to maintain such fixtures in a sanitary condition.

The common drinking cup is in use at the institution. The superintendent was of the opinion that although individual drinking cups and drinking fountains are in general desirable, they are impracticable in an institution of this kind owing to the class of patients cared for. I believe, however, that the common drinking cup should be abolished as soon as possible. Although it may not be practicable to provide individual drinking cups, I am of the opinion that drinking fountains may be so designed and placed as to eliminate largely, if not wholly, the objections raised against their use and that at least one such fountain should be installed at this institution as an experiment. If found to be satisfactory, as would probably be the case, they should be installed throughout the hospital.

Sewerage and sewage disposal

The sewer system consists of one combined sewer discharging into the Hudson river, to which several laterals are tributary and two storm sewers serving the driveways outside of the main buildings. One of the storm sewers discharges into a branch of the Fishkill creek and the other into the institution ice pond. The sewage from the combined sewer empties into a flush tank located about 200 feet northwest of the main group of buildings, from which it is discharged through a 12-inch vitrified tile pipe to the Hudson river about 1¾ miles from the institution. The point of discharge is about one mile above the dock at Fishkill Landing. Although a certain amount of sludge

and detritus is removed from the flush tank a number of times each year, this tank does not act as an efficient sedimentation basin, and I am of the opinion that the institution should take steps to provide for at least a partial treatment of the sewage before its discharge into the Hudson river. Owing to the comparatively small amount of sewage from the institution, the isolated location of the outlet, and since no water supply is taken from the river below the point of discharge, it should not be necessary at this time to provide for more than a preliminary treatment of the sewage. There appears to be adequate fall along the upper portion of the outfall sewer for the operation of a sewage disposal plant. The storm water should, however, be separated from the sanitary sewage before treatment works are installed. The storm water collected from the roofs and grounds could be discharged through a separate sewer into one of the water courses near the institution or into the existing combined sewer below the proposed disposal plant.

Garbage disposal

The garbage from the kitchen of the institution is placed in galvanized iron cans and wooden barrels, and these receptacles are collected twice daily both summer and winter and fed to the hogs maintained by the institution. The cans and barrels are cleaned and disinfected daily. The rubbish is burned and the ashes are used for filling and for road building.

Heating and ventilation

The institution is heated from a central heating plant. Indirect heating is used for the most part except in the laundry, where steam radiators are used. In three of the wards both steam radiators and indirect heating through registers are in use. In the large wards are six hot air inlets 18x20 inches and usually four outlets of the same size and one or two 20x48-inch flues for the exit of foul air. Hot air inlets are located about 8 feet above the floor and the outlets about 2 feet above the floor. Ventilation is also afforded through transoms and windows. The temperature is regulated by hand and maintained at from 68 to 70 degrees Fahrenheit. Thermometers are placed in the different rooms. Except in the laundry and women's kitchen both the heating and ventilation appear to be adequate, and the buildings were to a remarkable degree free from objectionable odors. In the laundry and temporary kitchen the only ventilation provided is through the windows which do not appear to afford adequate facilities for removing steam from the kitchen or laundry. I am of the opinion that a new laundry building as well as the kitchen planned in connection with the women's group should be constructed as soon as possible.

Owing to the crowded condition of the institution, beds are placed not only in the dormitories but also in the halls and corridors adjoining the dormitories of the different wards. This crowded condition in a few instances results in reducing the cubic per capita air space to as low as 400 cubic feet, and in one or two instances the air space in the day rooms is as low as 350 cubic feet per person. This condition, however, did not at the time of the inspection appear to vitiate the air to any considerable extent. It is evident, however, that the institution is overcrowded and that it should be enlarged in order to obviate the necessity of placing cots in halls and corridors and so that the dormitories will have an air space of not less than 600 cubic feet per person or a floor space of not less than 50 square feet per person.

The crowded condition of the institution would be relieved somewhat by completing the women's group of buildings and removing the 50 women patients now cared for in the main building to the women's building. This would only partially relieve the conditions, however, and in order to correct these conditions substantially it will be necessary to construct additional wards.

Milk

Both condensed and raw milk is used at the institution. All of the raw milk used is derived from the institution herd consisting of about 20 milch

cows. It was stated that 31 cattle of the herd were disposed of on account of tubercular infection last year, but that the present cows are in good condition and were said to be free from tuberculosis. The barn in which the cows are kept and milked was constructed with concrete floors and feeding troughs and was maintained in a very sanitary condition. The milk as soon as it is milked is taken to the new concrete milk house located about 200 feet from the barn, where it is cooled and passed through a clarifier, placed in cans and hauled to the main kitchens of the institution, where it is placed in large stoneware crocks in the kitchen refrigerators. The milk cans are usually returned within an hour after leaving the milk house. They are immediately rinsed, scrubbed with washing solution, again rinsed and sterilized with steam for two minutes and rinsed with hot water. The dairy is inspected daily by the steward and about once a week by the superintendent. The milk is tested twice a month by the Agricultural Department.

Conclusions and recommendations

Although the institution appeared to be maintained in general and, aside from conditions of overcrowding, in a sanitary condition, the following additions, alterations and changes are recommended:

1. That the overcrowded condition of the institution be relieved at once by
   - (a) The completion of the women's group of buildings, which should be done as soon as possible.
   - (b) The construction of additional wards which shall have not less than 600 cubic feet of air space and not less than 50 square feet of floor space per person.
2. That a new laundry provided with proper ventilating facilities be constructed.
3. That the new kitchen planned in connection with the women's group be constructed.
4. That certain of the old plumbing, more particularly the iron and old hopper closets and lavatories, be replaced by modern enameled-ware fixtures as soon as practicable.
5. That the branch soil pipes in the women's buildings be back-vented or that these soil pipes be provided with vent pipes carried independently through the roof.
6. That a fresh air inlet be placed on the house drain of the infirmary of the women's group.
7. That the separation of the storm water from the sanitary sewage and the preliminary treatment of the sanitary sewage before its discharge into the Hudson river be provided for.
8. That drinking fountains be installed throughout the institution.
9. That all kitchens, dining rooms and hospital or infirmary wards be screened during the summer.

Respectfully submitted,

THEODORE HORTON,
Chief Engineer

Albany, N. Y., *February* 1, 1915

Great Meadow Prison (Comstock)

Hermann M. Biggs, M. D., *State Commissioner of Health:*

I beg to submit the following report on an investigation of the sanitary conditions of Great Meadow prison. The investigation was made on January 22 and 23, 1915, by C. A. Howland, assistant engineer, and samples of the several water supplies of the institution were collected for analyses on January 29 by him:

Location and general description

Location.— Town of Fort Ann, Washington county, near the unincorporated village of Comstock

Capacity.— 1,246 inmates

Present population.— Inmates 618, of which 606 were at the prison at the time of the investigation, 4 being at the State Farm for Women at Valatie, 7 at Wingdale and 1 in the Glens Falls hospital suffering from appendicitis; guards, clerks, etc., 61; total, 679

Class of inmates.— Male felons transferred from other prisons

Area of grounds.— 998 acres

Number of occupied buildingss.— 14

Site of institution.— The institution is situated on elevated ground east of the village of Comstock and the Champlain canal. The main group of prison buildings stands on the hillside which rises to the east of a plateau elevated above the canal and the ground rises steeply behind the buildings. The drainage of the hillside in the rear of the group of main buildings is said to accumulate about the buildings and in some instances to have entered the cellars. It is expected that the grading of the land in the rear of the buildings which is now in progress will alleviate this trouble. The Champlain canal is the only water course of any size in the region, which is drained by small streams discharging into the canal.

Buildings

General description of buildings.— Of the 14 occupied buildings, 5 are included in the group of main buildings comprising the cell houses, cage, "old" dormitory, domestic building, laundry and bath house and power house, 9 residences occupied by the warden and guards. The remainder of the buildings are stables, barns, piggeries, chicken houses and other farm buildings. One building and an elevated water tank are located on a plot of 10 acres, on which the Conservation Commission maintains a tree nursery.

General physical and sanitary condition of buildings.— The construction work on the group of main buildings is not yet completed, although it is expected that the new domestic building and the wash house, although the new baths are now in use, will be ready for occupancy by the latter part of February, while the south wing of the cell house will be completed at a later date. The dormitory called the "old" dormitory is therefore used for practically all of the activities of the institution and will be used until such time as the new buildings shall be finished. All of the group of main buildings are built with concrete foundations, brick walls and slate roofs. The doors, windows and casings and the second floor of the "old" dormitory are of wood. All other floors are concrete. The buildings of this group are all comparatively new and do not yet show the effects of usage except in the case of the dormitory. It will therefore be sufficient to say that in general the condition of these buildings is good with the exception of the dormitory.

This dormitory, being used as it is for a great many purposes for which it was not designed, is overcrowded and shows the effect of excessive usage. All of the inmates of the institution with the exception of those acting as stokers, who are allowed to cook their own meals, are fed in the two mess halls of this building. All of the cooking, washing and laundry work is done there, and the storerooms, coolers, library, sick rooms, offices, tailor shops and cobbler shops are located in it. Therefore, although care is evidently exercised in maintaining the building in as good a sanitary condition as possible, yet the overcrowding produces conditions which are not satisfactory. As these objectionable conditions will be mentioned more specifically under later headings, it will be sufficient to say here that the plastering was knocked off in places, the paint marred, the floors worn and the lighting of some of the rooms inadequate.

The warden's residence is built of gray stone and five cottages for guards which are under construction are being built of concrete blocks and wood, with slate roofs. They will be served by the institution water supply and sewerage systems. All of the other houses occupied by the guards on the

prison property are built of wood, as are also the barns, stables, piggeries, chicken houses, etc., with the exception of the milk house, which is built of concrete blocks. The manure from the main barns is piled east of the storage shed and is said to be carted away every week. The concrete storage tank and urine tank, which were criticized in a former report of this Department, are no longer used. Neither the cow stable nor milk house are screened.

Water supply

The principal water supply of the institution is obtained by gravity from Dolph pond, which is situated in the hills about two miles northwest of the prison. Plans for this water supply were approved by this Department in 1909, and in the report upon these plans, following an investigation of Dolph pond and its watershed, the following conclusions and recommendations were made:

> 1. The proposed plans have been examined into only from the salient features of design such as its sanitary aspects, including the esthetic quality of the water, the yield and such features of the construction as pertain to the sufficiency and general practicability of the design, it being assumed that the details of design have been adequately looked into by the State Architect.
>
> 2. The water supply, which can be obtained from Dolph pond, will be free from contamination so long as there is no resident population on the watershed and fishing and boating on Dolph pond reservoir are prohibited.
>
> 3. The plans and contract do not provide for stripping the reservoir site on the shallow portions of Dolph pond. Unless this is done there is a strong probability that undesirable growths will develop and at times produce odors and tastes in the water.
>
> 4. If the dam is properly constructed and the pipe line laid in accordance with the plans and the accompanying specifications, these works should prove adequate for impounding and delivering the required amount of water to the institution.

The inspector was informed at the time of the present inspection that Dolph pond has not been stripped of its muck and vegetation as above recommended and that consequently disagreeable tastes and odors have occurred in the water. The plans for water supply were approved on condition "that the shallow portion of Dolph pond and the adjacent area which will be submerged be stripped of its vegetation and top soil."

In the autumn of 1913 and in December, 1914, the water obtained from the present water supply system was not sufficient to meet the needs of the institution. A steam boiler and pump were installed on the west bank of the Champlain canal at the point north of the highway bridge where the present main crosses the canal, and water was pumped from the canal to supply the institution. In 1913 it was necessary to pump for a period of about two weeks and in 1914 for a period of about one month. A Worthington duplex pump 10x6 inches by 10 inches was used, and the inspector was informed that the rate of pumping during the day was about 75 strokes per minute. About 10 o'clock at night the rate of pumping was cut down to a low night rate. The first mentioned rate for 16 hours per day, assuming a rate of 1,000 gallons per hour for the other eight hours, gives a total daily water consumption of about 160,000 gallons per day. The inspector was informed that this includes only water used for baths, flush closets, boilers, cleaning, etc., a well supply being used for drinking.

A third supply is derived from a driven well located under the new mess hall. The water is piped from this well to a faucet over the kitchen sink in the dormitory, and as far as could be learned to no other point in the institution except in the summer time, when the pipe is extended to a faucet in the prison yard. The well consists of a 3-inch casing driven through 109 feet of clay and sand. It was put down in June, 1911. The inspector was informed that there is no means of access to the well through the concrete cellar bottom of the mess hall. However, the discharge pipe line is exposed by the excavation for a driveway and must be relocated.

No plans for either the water supply derived from the artesian well or for that from the Champlain canal have been approved by this Department as required by law. These sources of supply are not shown on the plans approved by this Department referred to above, nor have subsequent plans been submitted.

The present inspection has brought out the fact that the volume of water obtained from Dolph pond by the present system of water works is inadequate to meet the needs of the institution, and as it has been found by a previous inspection that the volume of water to be obtained from this source, if properly collected, stored and distributed, is in excess of the present needs of the institution, there is obviously some point at which a serious loss of water is occurring. This may be due to a leaky dam or to leaks in the pipe lines, or because the dam has not been constructed to the height shown on the plans approved by this Department, or because for some other reason it is not possible to develop the entire yield of the watershed and storage capacity.

Plumbing

General type.— Since the buildings are of recent construction, the entire plumbing is modern and of the open type. The traps are not back-vented to a separate vent stack, but the headers are continued and connected with a soil pipe which is carried through the roof. The plumbing of the cells is contained in a utility corridor between the two halves of the tiers of cells and is readily accessible at all times. There are apparently a sufficient number of fixtures provided for all needs of the institution, but in the old dormitory, because of the fact that the rooms have in some instances been put to uses for which they were not intended, the toilets are improperly located. Thus in the mess hall is located a row of toilets which, however, are not in use, and a similar row of toilets is located along the side of the tailor and shoe shop, and these toilets were in need of repair. At the end of the south corridor on the second floor is located a toilet which was not cleaned and needed repairing and painting. It is evident that, because of the fact that the old dormitory is used as a congregating place for the inmates during the day, and practically all of the activities of the institution are carried on in this building, there are too few toilets for the number of persons using them.

In the kitchen a grease trap about 15 inches in diameter by 12 inches deep is provided to receive the wastes from the kitchen and from pans under the kettles, and the inspector was informed that the dish washing and water in which clothes are washed goes directly to the sewers, while the soapy water is used to wash the floors. Therefore it appears that, while the grease trap would under ordinary conditions be much too small for an institution of this kind, not all of the greasy or soapy waters are passed through it. In the new addition a brick grease trap containing a screen located outside and apparently of ample capacity is provided.

The roof leaders of the cell block are carried down outside the buildings, and the inspector was informed that trouble has been experienced with the freezing and bursting of these leaders. He was shown a damaged one which had evidently been impaired in this way. In the newer buildings the roof leaders are brought into the buildings and carried down inside, but in some instances, and specifically in that of the power house, the roof leaders have been connected with the sanitary sewers. The flushing plug was unscrewed from one of the roof leaders of the power house and a hose inserted. The wash of water into a sanitary sewer manhole when the water was turned on indicated that these roof leaders are connected with the manhole on the line of sanitary sewers, which is located approximately in front of the main door of the power house.

Several points of improper drainage in the power house were observed. In the boiler room the steam blow-off line is laid in a conduit in the floor back of the boilers, the conduit being covered by iron plates. When the floor is flushed the water enters this conduit, and it was stated that it stagnates and has to be pumped out, there being no outlet provided for it. In the coal bunkers insufficient light is provided, and the inspector was informed that

water enters them through the charging manholes in the roof. It was also pointed out to him that water enters part of the power house basement, through the openings through which electric light ducts leave the building and through cracks around the floor in this part of the basement.

Sewerage and sewage disposal

The sewage of the institution is collected in a system of sanitary sewers, plans for which were approved by this Department, as were also the plans of the disposal plant to which the sewage is conveyed. A separate system of storm sewers is provided to collect the storm water and discharge it into a watercourse at a point near a road north of the main group of buildings. An inspection of the disposal plant was made by a representative of this Department in 1913, and in the report upon that inspection recommendations were made in regard to the proper operations of the disposal plant. At the time of the present inspection it was found that the disposal plant, which consists of two settling tanks of the vertical flow type, a dosing tank, four sand filter beds and a sludge bed, were in a bad state of repair. The sand filters were out of use entirely, the dosing apparatus being either frozen or damaged to such an extent as to be temporarily useless. The effects of surface wash or flooding were noticed in one of the beds, the surfaces of which were frozen hard. A hole had been washed from the outer edge of the bed under the surrounding embankment.

At the time of the inspection the second settling tank was being discharged onto the sludge bed. The discharge pipe connects with a wooden trough before it enters the sludge bed and the sewage had overflowed the trough and passed directly through a washed-out ditch into the nearby watercourse. Such sewage as reached the sludge bed passed directly across it through the distributing trough, out the opposite end and through a similar washed-out channel into the stream. The distributing or diverting openings in the main distributing channel were not properly regulated.

The inspector was informed that it has never been possible to get more than three of the four dosing siphons to operate properly at one time. The sand filters are cleaned about once a year, at which time the upper two feet of sand are removed and replaced by fresh sand. It was said that the beds would operate successfully for a month or two, when they would begin to clog up, the clogging continuing until the bed was out of operation entirely.

The settling tanks are said to be cleaned in the early part of the summer, at which time the first tank will be about one-third full of sludge, but the second tank at such times contains little, if any, sludge. The sludge is removed from the tank by means of a bucket and rope mainly, it is said, because it is difficult to reach the sludge bed with a team. The flow of sewage is said to increase greatly during times of rain, at times to such an extent as to overflow the first tank. This fact alone would indicate the connections of roof leaders or surface water catch basins with the sanitary sewers, and this was corroborated by the investigation of the power house roof leaders above mentioned. It is also said that during thaws and at times of heavy rains the channel of the small stream is too small, and consequently the adjacent territory is flooded, including the sand filters, resulting in considerable damage to the latter.

During construction work about the farm outside privies of a crude construction are used. These are rough wooden buildings, with no vaults and without screens, located in a spot convenient to the work. The barn is provided with a flush closet which, however, is boarded up and is to be removed. The drainage of the barn passes into a sewer, discharging into a ravine leading to the canal, and the sewage from the warden's residence also discharges into the canal.

Garbage disposal

The garbage of the institution is collected in six uncovered galvanized iron receptacles and is said to be removed every morning and fed to the hogs which are kept on the institution farm.

Heating and ventilation

Heating.— Both direct and direct-indirect systems of heating are installed, steam supplied from a central plant (the power house) being used.

In the north wing of the cell block the fresh air ducts connecting the bottom of every alternate radiator with the outside air through the adjacent outer wall are not provided with cut-off dampers; consequently it is necessary to plug up these openings in winter with sticks of wood at the outside to prevent freezing of the radiators. In the south wing of the cell block now under construction the fresh air ducts are provided with dampers. With this exception the heating facilities appeared to be satisfactory.

Ventilation.—An exhaust fan system of ventilation is provided for the cells. Ducts near the top of each cell connect with a system of piping through which the air is drawn by means of 30-inch electrically driven fans located in stacks extending through the roof. Eight of these fans, which make 500 revolutions per minute, are provided to ventilate the 638 cells. At the time of the inspection several of the fans were out of use due, it was said, to the fact that the noise of the fans annoyed the inmates, who tied them up, with the result that the electric wiring was damaged when the fans were turned on.

In other parts of the institution natural ventilation is in use and is apparently adequate with the exception of the old dormitory. In this building, as stated before, the use of rooms for purposes for which they were not intended and the overcrowded conditions have overtaxed the ventilation, and consequently the odors naturally resulting were very pronounced in parts of the building.

Milk

The milk supply of the institution is obtained from the institution herd of cows, numbering 60 at the time of the inspection. At that time from 260 to 275 quarts of milk were being obtained per day, while in the flush season from 600 to 700 quarts per day are obtained. The milk is separated in the milk house adjacent to the cow stable, where butter is also made in the summer, but in winter the butter is made at the prison. Utensils are cleaned in hot water brought in milk cans from the prison and the floors of the milk house are mopped with warm water. This building should have its own independent supply of water, both hot and cold, and piping should be run from the main supply for this purpose. A sink is installed in the cow stable, where the milkers can wash their hands before milking. The sewage from the sink passes through a sewer which discharges into a ravine leading to the Champlain canal.

Conclusions and recommendations

The conditions found to exist at Great Meadow prison are probably in many respects more open to criticisms now than will be the case when the new additions are placed in service, which will be done, it was estimated, about the latter part of February of this year. The conditions of overcrowding, which produce undesirable conditions, especially in the case of the old dormitory, will then be alleviated. There are certain other conditions of an extremely serious nature, however, that will not be rectified by this relief. I beg to submit, therefore, the following recommendations:

1. With reference to water supply,

   (a) That a careful and thorough investigation be made immediately of the Dolph pond source of the water supply in order to determine why the full resources of the watershed are not being utilized and in order that any leaks or other sources of losses may be discovered and be repaired. The pond should also be stripped of all vegetation and muck at the earliest possible time as required by the conditions of approval of the plans.

   (b) That the use of water from the Champlain canal be discontinued.

(c) That ample precaution be taken against any possibility of contamination of the water supply derived from the driven well and that when necessary repairs and improvements are made to utilize more fully the Dolph pond supply, the use of the driven well be discontinued.

2. That the sewage disposal plant be repaired and put in service in accordance with the following recommendations, nearly all of which are included in a previous report:

(a) That the weir channels of the first settling tank be kept in repair and maintained so as to operate as intended by the plans.
(b) That the scum and all sludge be disposed of on the sludge bed.
(c) That the distribution trough of the sludge bed be kept in repair and properly regulated so that the sludge will be disposed of on the sludge bed and not in the stream, and that the sludge be drawn off at a lower rate so that it will not overflow the channel before it reaches the bed.
(d) That all the sand filters be repaired and placed in operation and used in rotation. In connection with this the siphons should also be repaired so as to operate efficiently. The filters should be cleared more frequently, one at a time by scraping off the surface accumulation of sludge which should not be allowed to accumulate to any great depth. Clean sand should replace the sand removed when necessary.
(e) That the diverting channels for surface water around the plant should be of sufficient depth and capacity to prevent the washing of surface water over the filters and that a channel should be provided for the stream sufficient to carry off the water at all times and prevent flooding of the disposal plant.
(f) That the wastes from the warden's residence and from the barns and milk room should either be disposed of by connections with the institution sewer system or direct to the present disposal plant or should be conducted to a settling tank, the overflow from which be allowed to percolate into the soil from a series of subsurface tiling.
(g) That all roof leaders, catch basins or other storm water appurtenances where it is found that these are connected with the sanitary sewers be disconnected and connected with the storm sewers.

3. That as soon as practicable the old dormitory be repaired where new plaster and paint are needed and the building placed in a better sanitary condition throughout. A concrete floor for the second story should also be provided.

4. That the use of the common drinking cup be discontinued and a drinking fountain be provided at every point where it is desired to furnish a common drinking water supply to inmates.

5. That the ventilation system of the cell block be put in working order.

6. That in place of the insanitary privies used in connection with the outside work sanitary privies having removable pails and screened from flies be used.

7. That a line to supply hot and cold water at the milk house be provided with necessary plumbing and sewage disposal and that this building be properly screened to exclude flies.

8. That the mess hall and kitchens be screened.

9. That the points of improper drainage and dampness in the cellars of the power house mentioned in this report be eliminated.

10. That the garbage be stored, collected and removed daily in covered receptacles.

Respectfully submitted,

THEODORE HORTON,

Chief Engineer

ALBANY, N. Y., *February 16, 1915*

Clinton Prison and Dannemora State Hospital (Dannemora)

HERMANN M. BIGGS, M. D., *State Commissioner of Health:*

I beg to present the following report on an investigation of the sanitary condition of Clinton prison and Dannemora hospital at Dannemora. These two institutions are under different executive managements, but since they are located at the same place, are both under the control of the State Commission of Prisons and have water supplies, sewage disposal and other features in common, both will be considered together in this report. The investigation of these institutions was made on January 25 and 26, 1915, by Mr. C. M. Baker, assistant engineer in this Department.

Location and general description

Location.— Village of Dannemora, county of Clinton

Capacity.—Clinton prison, 1,389; Dannemora State hospital, 358

Present population.— Clinton prison: Inmates, 1,438; employes, 125; total, 1,563. Dannemora State hospital: Inmates, 509; employes, 105; total, 614. Total population of both institutions, 2,177

Class of inmates.—At Clinton prison, male convicts; at Dannemora State hospital, convicts who have become insane

Area of grounds.— In the vicinity of the institutions the prison owns 625 acres, but considerable other land in the surrounding country is owned by the prison and about 13 acres are enclosed within the prison stockade

Number of occupied buildings.— Clinton prison, 15; Dannemora State hospital, 9

Site of institutions.— The institutions are situated at the foot of a mountain just to the north of the village of Dannemora, which is reached from Plattsburg over the Plattsburg and Lake Placid branch of the Delaware and Hudson railroad. The drainage of the site is good.

Clinton Prison

Buildings

General description of buildings.— The 15 occupied buildings include the administration building, five cell halls, mess room and kitchen and some eight industrial buildings. These buildings are all located inside the prison enclosure. Outside are located the barn and other accessory buildings.

General physical and sanitary condition of buildings.— The old cell hall, power house and boiler house are constructed of stone. All the rest of the buildings within the enclosure except the old stone shed, which is constructed of wood, are brick structures. The barn and other structures without the enclosure are constructed of wood. The laundry was destroyed by fire about two months prior to the time of the inspection, necessitating doing the laundering in the bath house or any other place in the institution where such work could be done. It is obvious that this caused unsatisfactory conditions in some of the buildings, but it was evident that the authorities were making use of the only means available. A request has been made to the Legislature for an appropriation to reconstruct this building. In general, however, it may be stated that the buildings, including the cellars and stables, were in very good condition.

Water supply

The main part of the institutional supply is derived from two reservoirs located in the side of the mountain north of the institution, one with a capacity of about 1,500,000 gallons and the other of 1,000,000 gallons, or a total storage of 2,500,000 gallons. These reservoirs are fed from some five or six small spring streams. The drainage area tributary to them lies on the side of the mountain, is wooded and does not exceed one square mile in area. All except 150 or 200 acres of this land is owned by the prison. Prior to last fall there had been no inhabitants on the area tributary to the reservoirs and the

only opportunity for pollution was from chance trespassers, but during the last winter there has been a lumber camp of some ten persons located on the watershed on land not belonging to the institution. This camp was visited by the inspector and found to be located near the source of a small spring brook which had been diverted into the lower reservoir, whence the water is delivered by gravity to the institution. However, if allowed to follow its natural course the stream would discharge below the reservoir. The privy at the camp was not provided with a vault, the feces being allowed to collect directly on the surface of the ground. A rain or sudden thaw would be apt to wash the fecal matter into the reservoir, which is less than one-half mile distant.

At the time of the inspection ice was being cut from the lower reservoir and it was evident that no special precautions were taken to prevent the pollution of the water by the men and teams engaged in this work. Another source of ice supply should be provided, thus eliminating this possibility of contamination of the water.

At times the water supply from the reservoir is insufficient for the needs of the institution, in consequence of which water is occasionally pumped from an 8-inch well located within the prison enclosure and drilled to a depth of about 285 feet. Arrangements are also being made to pump water from an old mine shaft located on the side of the mountain near the reservoir. Although both of these wells appear to be free from sources of pollution, it is very important that if they are to be used as supplementary sources the driven well should be carefully protected against future sources of contamination and the mine shaft carefully guarded against trespassing or other incidental or wilful sources of contamination.

There is a cross connection between the institution and village supplies so that in case of accident or other necessity each may obtain water from the other's supply. The source of the village supply is similar to that of the institution, but is not subject to pollution from a camp, and evidently should furnish water satisfactory in quality.

Samples were taken of both the institutional and village supplies and sent to the Division of Laboratories and Research for analysis. The samples of the institutional supply represent water from the reservoir, none being taken from the well supply. The results are appended hereto.

With reference to the institutional supply, it will be seen from the low count and absence of B. coli that the sources of possible contamination of this supply were not active at the time of collection of samples. This analysis, however, in no wise lessens the significance and importance of the fact that contamination and even infection is possible under certain conditions and that these possible sources should, as stated above, be rigidly excluded.

The analyses of the village supply indicate by the low count and comparative absence of B. coli that this supply is, as pointed out above, practically free from pollution, except, perhaps, from chance sources, and these should, as in the case of the institutional supply, be rigidly guarded against.

Plumbing

The plumbing is of the open type, except in the warden's house and old hospital. No plumbing is provided in the cells, except that in each cell block a toilet has been located in one cell for general use. These toilets are provided with neither house traps nor fresh air inlets and set directly over the sewer which passes under the cells. The pail system is in vogue for removing the sewage from the cells. The pails are carried out by the prisoners to the bucket house in the morning, where catch basins and running water are provided for emptying and cleaning them. After being emptied and rinsed the pails are set on racks, where they stand in the open air during the day, being returned to the cells at night. They are washed two or three times weekly with hot water and soap and sterilized with creoline. No special vent shaft nor place is provided in the cells for keeping the pails. While it appears that the pails are handled and cleaned in a satisfactory manner, this method of collecting and disposing of such wastes is objectionable, and the matter of providing toilet facilities in each of the cells should be seriously considered by the prison authorities.

Plumbing fixtures are insufficiently provided in some of the hospital wards and industrial buildings. One of the tubercular wards accommodating 105 persons is provided with only three toilet seats, no urinals and three lavatory bowls. Weaving Shop No. 2, where some 45 men work, is provided with only one toilet seat and one sink with a faucet. These facilities, as described above, are insufficient. The other wards and industrial buildings lack urinals and are insufficiently provided with lavatory bowls. In order to maintain satisfactory sanitary conditions in the toilets, urinals of a sanitary type provided with effective automatic flushes and properly equipped with vents should be provided in all cases. Toilet and lavatories should also be sufficiently provided in all cases, especially in view of the fact that no plumbing fixtures are provided in the cells.

The bath house is equipped with 25 shower baths for some 1,400 people, or one bath for every 56 people. While the present number of showers may suffice, it would seem that more are advisable. The baths are not enclosed in booths, and although this may not be considered a serious criticism, the modern and desirable practice appears to provide a separate booth for each bath.

Sewerage and sewage disposal

The sewage disposal at Dannemora was the subject of special investigation by the Department in 1908 (see volume 29, page 152, annual report, State Department of Health), at which time insanitary conditions were found to exist which resulted in recommendations being transmitted to the proper authorities that improvements be made in the system and method of disposal. Plans were accordingly submitted to the Department for approval by the State Architect in 1910. (See volume 31, page 397, annual report.) The plans provided for the collection of the domestic sewage from the combined sewers of the institution, regulating the flow by storm water overflows and conveying the sewage through new sewers to a settling tank to be located about one-half mile from the institution. These plans were approved on the following conditions:

1. That the capacity of the settling tank be increased whenever the daily contribution of sewage shall materially exceed the amount of flow which the tanks as now designed will properly treat.
2. That the complete separation of sanitary sewage and storm water shall be effected at such time as additional purification of sewage shall become necessary.
3. That sludge beds shall be installed if the proposed method of caring for the sludge is found to be inadequate or unsatisfactory, and at no time shall sludge be discharged into the stream.

The system was subsequently constructed, but evidently not according to the plans as approved. The plans indicate a manhole, designated on the plans as "M. H. No. 17," located 400 or 500 feet southwest of the warden's house. At this manhole a 6-inch sewer was to intercept the domestic sewage from an existing 4x4-foot storm sewer and a storm water overflow was to be constructed. This manhole was never constructed. The inspector was informed that an attempt had been made at the time of the construction to provide an overflow. However, with the first heavy storm after the completion of the work the 4x4-foot storm sewer flooded the basement of a nearby store under which it passed. To eliminate this difficulty the storm sewer was closed, leaving only the 6-inch sanitary sewer to care for both domestic and storm sewage. This resulted in the destruction of the sanitary sewer and the flooding of other basements at the time of the next storm. A large combined sewer was then constructed to convey the sewage about 150 feet further to the southwest, whence it discharges under a barn into an open drain which is usually dry except for the sewage. This outlet is located only about 30 feet from a dwelling and the drain passes to the rear of a row of houses located 100 to 150 feet distant. The conditions now existing therefore are the same as before the construction of the sewage system. Another storm water regulator located at a manhole (designated on the plans as "M. H. No. 9") shows 2,000 feet south of the institution was so constructed that the overflow is 1½ or 2 feet above

the outlet of the sanitary sewer leading to the settling tank instead of at the same elevation as is indicated on the plans. This resulted in clogging the smaller sewer with rags and other similar material which collected in the bottom of the manhole, and the sewage at the time of the inspection and for some time prior thereto had been discharging into a dry drain at this point, the conditions thus being the same as before the system was constructed. A very small stream of sewage was trickling into the settling tank. It is thus evident that the system as constructed and operated is useless and that the same conditions now exist that were found to exist at the time of the 1908 investigation. In fact, the conditions are now even worse because of the increased amount of sewage. These insanitary conditions were also the subject of a special investigation by John A. Smith, M.D., sanitary supervisor for District "A," whose report under date of November 21, 1914, described and severely criticized the conditions. Copies of this report were transmitted to the proper authorities and recommendations made regarding sanitary improvements. Below the outlet of these sewers, especially the east sewer, which receives the drainage from the Dannemora State hospital, large quantities of rags, ropes and other similar material were noticed in the sewage. This would be apt to cause trouble in any sewer, and it is evident therefore that screens or catch basins should be provided near the buildings to intercept and prevent this material from entering the main sewer system. To satisfactorily overcome and permanently eliminate the insanitary conditions now existing with reference to the sewage disposal, plans and specifications should be provided for a new or modified system of sanitary and storm water sewers and be submitted to the State Department of Health for approval. The system should then be constructed according to the plans as approved. This matter should be given prompt attention by the proper authorities and the work should be completed as soon as possible. The conditions in the village during the next summer will necessarily be very insanitary and objectionable unless corrected.

Heating and ventilation

Heating.— The direct system of steam heating is used except in the administration building and warden's house. Steam is furnished from a central plant. So far as could be determined by the inspector the facilities for heating the buildings were adequate and satisfactory.

Ventilation.— The cells are 4x7 feet 4 inches by 7 feet high, thus containing about 205 cubic feet of air space. The doors, however, are open grating, thus allowing free circulation from the large corridors. A small vent pipe is also provided in the back of each cell, the corridors in the cell blocks are amply provided with ceiling vents and also with fresh air inlets near the floor. It is thus evident that the ventilating facilities for the cells are quite satisfactory. The kitchen is equipped with a steel ceiling and is rather low. The ventilation is unsatisfactory, being only from windows at the side. At the time of the inspection the steam had collected and condensed on the ceiling and the water was dripping to the floor. Better ventilation should be provided here to carry off the steam and odors. Practically the only ventilation provided in the industrial buildings is from the windows, which in some cases appears to be insufficient. This unsatisfactory condition was particularly noticeable in the first cotton shop, where the nature of the work causes considerable dust. At the time of the inspection the air appeared to be stale and the ventilation insufficient. Either more use should be made of the windows for ventilating the building or properly constructed ventilating flues should be provided.

Milk

The milk is furnished from the institution herd of some 30 cows. Part of the herd was tested about a year ago for tuberculosis, at which time one or two cows were condemned and killed. Since then, however, a number of cows have been added to the herd, but have not been tested, and it is therefore somewhat uncertain as to whether the herd is free from tuberculosis. The dairy barn is sufficiently provided with air space and ventilating facilities,

but some of the cows were dirty and did not appear to be in good physical condition. The milk room adjoining the cow barn appeared to be satisfactorily equipped with hot water, sink, concrete floor and aerator for cooling the milk. Open type pails, however, were used for milking instead of the narrow neck pails. The milk is delivered to the cooler at the institution immediately after being cooled at the dairy. The cans are sterilized by steam at the kitchen. It is evident that greater care should be taken to keep the stock clean and, further, that the herds should be regularly tested for tuberculosis. With these extra precautions and also by maintaining sanitary methods of handling the milk, a satisfactory supply should be produced.

Dannemora State Hospital

Buildings

General description of buildings.— The nine occupied buildings previously mentioned include the administration building, three buildings containing wards for patients, mess hall, power house, shop and two cottages for officers. In addition to these there is a barn and other accessory buildings. The administration building is three stories high and the building containing the patients' ward two stories. They are all constructed of stone except the cottages and other minor buildings, which are wooden structures.

General physical and sanitary condition of buildings.— The buildings are comparatively new and were in a satisfactory state of repair and good condition at the time of the inspection. No insanitary conditions were found in any of the basements nor about the barn.

Water supply

The water supply is derived from the same source as that of Clinton prison and has been previously described.

Plumbing

The plumbing is of the open type and the Durham system. It is satisfactorily provided with house traps, fresh air inlets, etc.

The condition of the plumbing appeared to be satisfactory, but the number of fixtures were insufficient in some cases. The following table indicates these unsatisfactory conditions to some extent, although no attempt has been made to report them all. In the first column is given the number of the ward, in the second the number of occupants and in the remaining columns under each type of fixtures is given the present number and the minimum number of fixtures that should be provided:

WARD	Number occupants	Toilet Seats		Urinals		Lavatory Bowls	
		Present number	Required number	Present number	Required number	Present number	Required number
1	73	5	5	......	2	2	7
3	122	5	9	......	3	2	12
4	100	5	8	......	2	6	10

It is seen from the above table that these are entirely inadequate in some cases. It is particularly noticeable that no urinals are provided, and it would therefore seem difficult to maintain satisfactory sanitary conditions, especially in view of the fact that the toilet seats are of the nonlift type. It is further evident that the bathing facilities are insufficient in some cases at least. Ward No. 3 has only two shower baths for 122 patients, while at least three should be provided. The institutional authorities should provide the additional plumbing fixtures needed as soon as possible.

Sewerage and sewage disposal

A combined system of sewers ranging in size from 4 to 12 inches collects both the domestic and storm water sewage and discharges into the east main from Clinton prison. Therefore the description and criticism of the method of disposal of the prison sewage is also applicable to the hospital. One 4-inch sewer on the hospital grounds about 150 feet long and receiving a small amount of sewage from a shop was clogged and being dug up for repairs at the time of the inspection. The cause of this clogging could not be determined, but may be due either to insufficient slope, the small size of the sewer or material flushed into the sewer. Aside from the above condition it was apparent that the sizes and slopes of the sewers were sufficient.

Garbage disposal

The kitchen garbage is collected in covered galvanized iron cans and fed to pigs daily. Refuse and other garbage is burned at an improvised incinerator. The methods of disposal appear to be satisfactory.

Heating and ventilation

Steam for heating is furnished from a central plant. The superintendent's residence, however, is heated by hot water. Both the direct and indirect systems of heating are in use. In all cases except in Ward No. 4, where the indirect system is in use, the fresh air is drawn from outside the building, but in this ward the flues have not been completed, and consequently air is being drawn from the basements. This practice should be discontinued as soon as possible, especially in view of the fact that a part of the basement is now being used for a dining room for some of the lowest grade of patients.

Ventilation is provided to some extent in the wards by means of foul air flues carried to the roof and also by fresh air inlets generally in connection with the indirect system of heating. In a number of wards the overcrowding of the institution was very apparent from the fact that the floor space and air space are entirely insufficient for the number of patients being cared for in them. The following table records some of these unsatisfactory conditions, although no attempt has been made to list all cases where the floor and air space were insufficient:

WARD	Number of beds	Square feet of floor space	Cubic feet of air space	Remarks
Basement No. 2				
Dormitory	5	50	400	Three small basement windows.
Dormitory	9	39	312	Five small basement windows.
Ward No. 3				
Dormitory	24	37	410	
Dormitory	12	33	360	
Ward No. 4				
Dormitory	8	40	440	Tile floor, lowest grade of patient strong and disagreeable odor.
Dormitory	10	35	385	

The rooms in the basement under Ward No. 2 being used as dormitories for patients are somewhat damp and improperly ventilated. It is noticeable that in one of these rooms the floor space was only 39 square feet and the air space 312 cubic feet per bed. In one case, Ward No. 3, the floor space is 33 square feet and the air-space 360 cubic feet, and in one of the dormitories of Ward No. 4 used for the lowest grade of patients the floor space was 40 square feet and the air space 440 cubic feet per bed. A very disagreeable odor was noticeable in this ward. In no case should the floor space be less

than 50 square feet and air space 600 cubic feet per bed, and in cases where the ventilation is not good or where a low grade of patients are cared for, as in cases mentioned above, more space should be allowed accordingly. In addition to sufficient space in the dormitories, suitable day room space should also be provided. These unsatisfactory conditions will doubtless be relieved when the new building nearly completed is ready for occupancy. However, it seems advisable to emphasize the necessity of making this change as soon as possible and of preventing the occurrence of such conditions in the future.

Milk supply

The greater part of the milk for the institution is furnished by an outside dealer, who probably obtains a part of his supply from other farmers. His dairy was inspected some time prior to this inspection by the authorities of the institution and, though not modern in all respects, was found to be in fair condition. The institution provides an aerator for cooling the milk at the dairy. Information was not available as to whether the herd is tubercular free, and it was evident that no recent tests of the herd had been made.

The institution has a herd of nine cows. The cow barn was clean and appeared to be well cared for, although it is not a modern structure and no milk room is provided. The milking utensils are washed and scalded at the kitchen, but the pails and milk cans were found stored in the cow barn just back of the stanchions. No hot water is provided at the barns. It is not known whether the herd is free from tuberculosis.

In view of the uncertainty as to the condition of the herds furnishing the milk for the institution, the somewhat questionable conditions of the dairies and the difficulty of the institution controlling the sanitary conditions when the milk is furnished from outside the institution, it would seem advisable that the institutional authorities provide sufficient modern facilities and a sufficient number of cows to furnish all their own milk supply and, further, that the herd thus obtained be free from tuberculosis and that tests be made frequently and the herd maintained tubercular free. If the above arrangements cannot be made, it would seem advisable to provide a modern pasteurizer and pasteurize the milk; also to make regular and frequent inspections of all dairies furnishing milk to the institution and, further, that a milk house properly equipped be provided at the institution barn.

Conclusions and recommendations

In view of the foregoing and after careful consideration of the conditions at these two institutions, I beg to submit the following conclusions and recommendations, referring only to needed improvements at Dannemora State hospital not covered by certain of the recommendations concerning Clinton prison:

With reference to Clinton prison, I recommend,

1. Concerning the general condition and adequacy of the buildings —
   That a new laundry building be constructed as soon as possible.
2. Concerning the water supply —
   - (a) That the flow of the small spring brook which takes the drainage from the lumber camp be diverted back to its natural course so that it will discharge into the stream below the reservoir.
   - (b) That careful inspection of the watershed tributary to the reservoir be maintained at all times and all possible sources of contamination of the supply be eliminated.
   - (c) That the driven well be carefully protected at all times from any contamination from both surface wash and underground seepage.
   - (d) That if it is intended to use the abandoned mine shaft as a source of water supply, ample precautions be taken against any possibility of contaminating this supply by preventing all trespassing in the shaft or its vicinity.

(e) That the practice of cutting ice on the lower reservoir be discontinued.

3. Concerning the plumbing —

(a) That serious consideration be given to the installation as soon as practicable of toilet facilities in each of the cells.

(b) That additional toilets, urinals, baths and lavatory bowls, the inadequacy of which fixtures is discussed in detail in the body of this report, be provided at an early date.

4. Concerning sewerage and sewage disposal —

That steps be taken by the institutional authorities to have plans prepared for a remodeling of the sanitary sewerage and the storm water sewerage which shall provide for a complete separation of all storm water from roofs and grounds from the sanitary sewage of the two institutions, and for the conveyance of all sanitary sewage to the disposal plant for proper treatment before its discharge into the stream.

5. Concerning ventilation —

That better ventilating facilities be provided or that better ventilation by means of the windows be maintained in the case of the kitchen and in the case of the cotton shop.

6. Concerning the milk supply —

(a) That greater assurance be had that the institution herd is free from tuberculosis.

(b) That the cows be kept in cleaner condition and additional precautions be taken against contamination of the milk supply, such as the use of narrow-neck milking pails.

With reference to Dannemora State hospital, I recommend,

1. Concerning plumbing —

That additional plumbing fixtures be provided, as indicated in the body of this report.

2. Concerning sewerage —

That in the reconstruction of the sewer system, as above recommended, provision be made by the use of screens where necessary to prevent clogging of the sewer connections.

3. Concerning heating and ventilating —

That the improper ventilation in Ward No. 4 and the overcrowding of the various wards be remedied as soon as possible by the completion of the additional building.

4. Concerning the milk supply —

(a) That the herd at the institution be increased to meet the demands for milk supply and that it be regularly tested for the purpose of keeping it tubercular free, or

(b) That, if it is impracticable at present to increase the institution herd, a modern pasteurizer be installed to pasteurize all milk and that regular inspections be made and proper steps be taken to insure that milk received from outside sources is of satisfactory quality.

(c) That a milk house properly equipped be provided at the institution barn.

Respectfully submitted,

THEODORE HORTON,
Chief Engineer

ALBANY, N. Y., *February 9, 1915*

Sing Sing Prison (Ossining)

HERMANN M. BIGGS, M. D., *State Commissioner of Health:*

I beg to submit the following report on an investigation of the sanitary conditions of Sing Sing prison at Ossining made on January 27, 28 and 29, 1915, by Mr. C. A. Holmquist, assistant engineer in this Department.

Location and general description

Location.— Ossining
Capacity.—Inmates, 1,200
Present population.— Inmates, 1,639; attendants, 146; total, 1,785
Class of inmates.— Convicts
Area of grounds.— 11.5 acres inside of inclosure; 63.5 outside of inclosure
Number of occupied buildings.— 14

Site of institution.— The prison proper is located on a low, flat strip of land between the Hudson river and the New York Central and Hudson River railroad tracks. The elevation of the ground inside of the prison inclosure varies from about two feet above high water near river front to about 10 feet above high water near the railroad. The ground of the prison property outside of the prison wall east of the railroad rises to an elevation of about 150 feet above tidewater.

Buildings

General description of buildings.— Of the 14 buildings, three buildings are used for the detention of prisoners. The remainder of the buildings includes the warden's residence, industrial building, mess building and hospital, kitchen, bath house, boiler houses and stables.

General physical and sanitary condition of buildings.—All of the buildings inside of the prison walls, except the stable, north boiler house and the Bertillon house, are constructed either of stone or brick. Owing probably to the low level of the ground, no buildings except the warden's residence and the mess room building, containing the mess room, hospital, chapel, dormitory and school rooms, have cellars or basements. The two basements referred to are constructed with concrete floors and were dry at the time of the inspection. It was learned, however, that water seeps into the basement under the mess room during extreme high water conditions of the river.

The cell house, or so-called main hall, forms the central portion of the easterly inclosure. It is a single-story stone building with an attic. The inside dimensions are 479 feet long, 37.5 feet wide and 46 feet high to the ceiling.

The cell house is well lighted by about 1,000 small windows 12x36 inches in size and by 31 large windows 4.5 feet wide and 30 feet high. There are 20 of the large windows on the east side of the building and 11 on the west side. Each of the large windows consists of six movable sashes with 12 12x18-inch window panes in each sash.

Centrally located in the cell house are two masonry cell blocks, each of which is 227.5 feet long, 20 feet wide and 46 feet high. There are six tiers or galleries of 100 cells in each block, equal to a total of 1,200 cells in the two blocks. The cells in each tier are placed back to back.

Each cell is 7 feet long and 3.3 feet wide by 6.7 feet high and is provided with an entrance 6 feet high by 1.6 feet wide by 2 feet deep, giving a total air space of about 170 cubic feet. At the time of the inspection 171 of the cells were occupied by two prisoners. Only the upper portion of the doors in the lower five tiers of cells are grated for the admission of light and air. In the top cells the doors are grated from top to bottom. Near the upper corner of each cell is a small opening for ventilation which connects with a duct or flue constructed in the walls between the cells and terminates in the attic above the cell blocks. The small openings vary in area from 6 square inches to 20 square inches. The area of the large ducts to which the small foul air outlets of the five lower tiers of cells connect averages about 130 square inches. There are 36 of these large ducts. The small ventilating openings of the top tier of cells open directly into the attic. Extending through the roof of the

attic are five ventilators 2 feet in diameter at the base and top and restricted to 1.5 feet in diameter near the center. An electrically driven exhaust fan 24 inches in diameter driven at a speed of 750 revolutions per minute is inserted into each of the ventilators. These fans were installed last September and are operated from 4:40 p. m. to 3 a. m. and from 7 a. m. to about 12 m.

The cell house for prisoners condemned to death is a one-story structure well lighted, heated and ventilated. The 17 cells in this building are about 8 feet long, 6 feet 4 inches wide and 7 feet 6 inches high. In nine of the cells the night bucket is used and eight of the cells are provided with flush closets and hand basins. The plumbing is old and in all but one of the cells is of the inclosed type. This cell house is, however, to be abandoned and a new cell house for condemned prisoners is under construction. The new building, which is to be 53 feet long, 30 feet wide and 14 feet high, is to be well lighted and ventilated and is to contain 23 cells, 12 of which are 6 feet-8 inches by 8 feet by 7 feet high, and the remainder 6 feet-8 inches by 8 feet-6 inches by 7 feet high. Each of the cells is to be provided with a modern enameled-ware flush closet of the non-lift type and one enameled-ware hand basin. The dark cells for the punishment of prisoners have been abandoned and only two large cells with barred fronts are maintained for the detention of prisoners under observation as to their mental condition.

Owing to the crowded conditions of the main cell house and in order to obviate as far as possible the locking more than one prisoner in the small cells, some 200 so-called Grade A prisoners sleep on hospital cots in a dormitory above the mess room. This room is 88 feet long, 73 feet wide and 20 feet high, giving an air space of 635 cubic feet per person.

The factory or industrial buildings are constructed of brick, with wooden floors, and are two and three stories high. All except the cart and wagon shop, which has recently been reconstructed, are old. Although they are for the most part amply provided with windows, the rooms of some of the shops are so wide that on overcast days the central portions of the rooms are improperly lighted. In one corner of the bakery above the kitchen is a sink and water closet. The latter is inclosed in a booth open at the top. This water closet should be removed from the bakery.

The kitchen where the food for the prisoners is prepared and the dishes washed is located on the ground floor below the bakery and between the mess room, the bath house and south boiler room. It is a room only 45x55x14 feet high and on account of its inclosed location is improperly lighted. The cookers and steamers are placed against the wall, which makes it almost impossible to get behind them and properly clean the floor after each meal. There is also a screened partition between the cooking and dish washing portions of the kitchen, and cabinets and tables are placed against this partition, which also interferes with the proper cleaning of the kitchen and maintaining it in a sanitary condition. The kitchen is provided with a ventilating flue 3x6 feet in cross section, but the motor on the exhaust fan near the top of the flue has been burned out.

The stables of the institution appeared to be maintained in a clean condition. Manure was piled outside of each of the two stables. It was stated that although straw manure is stored until a load has accumulated in the winter, it is hauled away and deposited on the prison farm every day during the summer. Shavings and sawdust are used for bedding in the stalls to a considerable extent, and this so-called shaving manure is hauled away daily and dumped in the basin of the Hudson river outside of the prison inclosure.

Water supply

The institution has a dual supply. The supply for potable purposes is obtained from the Croton aqueduct of New York city. The water used for flushing water closets, fire protection in the factory buildings and for laundry and bathing purposes is derived from springs in two abandoned quarries on the institution property.

The water from the Croton aqueduct discharges through a 6-inch cast iron pipe into a rectangular open masonry reservoir located on the hill east of the

prison at an elevation of about 140 feet above the general elevation of the ground inside of the inclosure. The reservoir is 99 feet long, 34 feet wide and 21 feet deep and the water is maintained at a depth of about 12 feet, affording a storage period of about 1½ days. The water entering the reservoir falls through a distance of about 10 feet. The water is conveyed by gravity to the prison through one 4-inch pipe and one 8-inch pipe. A blowoff for the reservoir is provided for this structure and another for the distributing system into the river near the prison inclosure.

Although the masonry walls of the reservoir extend above the ground and there appeared to be no sources of pollution of a permanent nature, the reservoir, which is open and is not fenced in, is located only a few feet from a road and would be subject to wilful pollution. I believe therefore that the reservoir should be covered and that a fence with a gate provided with a lock should be constructed around it in order to protect it from possible contamination.

The ice used at the prison for cooling and the water for flushing, bathing and laundry purposes, called the spring supply, is derived from two abandoned limestone quarries which have a very limited watershed and appear to be fed almost entirely by springs. The upper quarry, which is located 250 feet southeast of the reservoir, has an area of about one acre and is used for ice cutting. The elevation of the water surface of the ice pond is about 10 feet lower than that of the reservoir, and when the water in the pond is low during the ice harvesting season it is replenished from the Croton supply through a connection with the institution distributing system. Any excess water from the upper quarry or ice pond either seeps through the ground or flows over the surface of the ground to the lower quarry located about 400 feet south of the ice pond. A dam has been constructed across the lower end of the pond which has an area of about one-third acre. The high water mark is some 50 feet below the water surface of the upper pond and about 60 feet below the water surface of the reservoir. The main distributing pipe serving the institution with this auxiliary supply extends from the lower end of the pond. There is a cross connection between the main distributing system of the potable supply, and the valves and piping are so arranged that in case of shortage in the supply of spring water the spring supply may be shut off and the Croton water used for all purposes.

The upper quarry or ice pond is located about 50 feet from State and Lafayette streets, and there is a possibility of leakage into this reservoir of sewage from sewers in these streets due to the limestone formation, in which fissures are generally present. In the case of the lower pond there appears to be only one possible direct source of pollution, namely, from a privy in connection with a building located on the bank of the pond at a distance of about 50 feet from the water's edge. The privy should either be abandoned or it should be provided with water-tight removable containers. Owing to the nearness of sewers to the upper open pond and the consequent possibility of pollution of its waters and to the fact that either seepage or overflow from this pond into the lower pond would extend to the lower pond the influence of any contamination of the water of the upper pond, it is believed that this use of this pond for water supply purposes should be abandoned, or at least that the use of this water for flush closets, baths and in the laundry should certainly be discontinued, even if the pond is retained as a source of water for fire protection.

Samples of water for chemical and bacterial analyses were collected from the two sources of supply, and the results of the analyses of these samples are shown in the table appended. These analyses corroborated the results and conclusions of the investigation with respect to the unsafe quality of the water in the two ponds.

Plumbing

General type.— Although some of the plumbing is very old most of it is open and has been installed within the past 10 years. The condition of the piping appeared to be satisfactory and no serious leaks were found at the time of the inspection. All main drains are trapped and, with the exception of the main drain from the cell house, are provided with fresh air inlets. Except

the soil pipe from the fixtures in the toilet for the school rooms, all main soil pipes are carried through the roof. There are no long branch soil pipes, as the fixtures in the different buildings are grouped and the soil pipe of each group extends through the roof. Although some of the fixtures located close to soil stacks are provided with anti-siphon traps, not vented, with a few exceptions, the rest of the traps are vented separately and the vents returned to the soil stack above all fixtures.

In general the number of fixtures in the different buildings, more particularly in the large shops, are inadequate for the present population. In order to provide adequate toilet facilities there should be two showers, eight closets, two urinals and ten lavatories per 100 persons. Although no attempt has been made to record all cases where unsatisfactory conditions exist, some conception of the inadequate toilet facilities may be obtained from the following table:

PLACE	Number of occupants	Water closets	Urinals	Lavatories	Remarks
Dormitory	205	3	1	1	Long iron lavatory.
Knitting shop	173	5	2	1	
Shoe shop	130	4	2	1	
Clothing shop	118	7	1	1	
Foundry	62	3	1	1	Also two shower baths.
Brush shop	42	1	1	1	
Mat shop	40	2	1	1	

In the more crowded shops the almost continuous use of the closets and urinals appeared to make it difficult to maintain these fixtures and surroundings in a sanitary condition, and objectionable and offensive odors were given off from some of them.

There should be from two to three times as many fixtures in the shops as there are at present.

Additional shower baths should be installed in the bath house, as there is an average of only one shower per 100 persons.

As noted above, the bucket system is used in the cells. The buckets were originally white enameled iron, but are so old that the enamel has in most cases chipped off or become discolored and pitted. The buckets are provided with covers, and each prisoner is required to empty his own bucket each morning. The buckets are then cleaned, disinfected and allowed to air during the day. Each prisoner is given an enameled drinking cup for his own use when he enters the prison.

Sewage disposal

The sewage from the prison is collected by a system of combined sewers which vary in size from 6 inches to 10 inches in diameter. They discharge into the Hudson river through some nine different outlets. The mouths of the sewers are about midway between the high and low-water marks. No plans for this system of sewers have ever been submitted to or approved by this Department as required by law.

The contents of the buckets from the cells are discharged into a basin of the river formed by two 200-foot piers about 300 feet apart. The buckets are dumped into tin hoppers located just inside of the west fence of the prison. Short lengths of pipe extend from the bottom of each hopper which empty into the basins above the low water mark of the river. The buckets when emptied are placed on benches along the prison fence and are cleaned and disinfected by a squad of men and left to air until the time for locking up the prisoners. Very offensive and objectionable odors, which could be noticed at a distance of 200 feet from the hoppers, are created during the dumping of the hoppers. This condition is further aggravated during the winter, when,

owing to the elevation of the outlets from the hopper, the contents of the buckets are discharged on top of the ice.

The seriousness and danger of the present method of disposing of the excreta from the cells is further increased by the comparatively close proximity of the dumping hoppers and bucket racks to the mess room and kitchen. The dumping hoppers are about 150 feet from the mess room and about 300 feet from the kitchen, and some of the bucket racks are not more than 100 feet from the mess room and 250 feet from the kitchen. Neither of these rooms are screened from flies during the summer.

It is therefore imperative that steps should be taken to remove as far as practicable the dangerous and objectionable method of disposing of the sewage from the prison. In the first place, the mess room and kitchens should be effectively screened during the summer, and since the bucket system probably cannot be eliminated so long as the present cell blocks are in use, the dumping place should be further removed from the building where food is handled, cooked and eaten. The entire sanitary sewage of the prison should be treated before its discharge into the river.

Owing to the comparatively small amount of sewage discharged from the institution and to the large dilution afforded by the Hudson river, and since no water supplies are derived from the river below Ossining, it should not be necessary to require more than a preliminary treatment of the sewage by sedimentation or effective screening at this time. A complete separation of the storm water from the sanitary sewage should be made a part of any plan for the treatment of the sanitary sewage, inasmuch as it would be impracticable to provide for a sewage disposal plant to properly treat the combined sewage of the institution. Owing to the low elevation of the general level of the ground of the prison above the high water level of the river, it is probable that the sanitary sewage could not be collected and conveyed to and passed through a sewage disposal plant by gravity flow.

It would appear that it would be necessary to construct a marginal sewer near the river front to intercept the sanitary sewage and convey it to a central pumping station, from which it could be pumped to a disposal plant at a suitable site on the prison property. There appears to be sufficient area available for such a plant north of the northerly prison wall. Pending the installation of flush closets and a new cell block the buckets from the cells could be discharged either directly into hoppers leading to the pumping station, or if proper flushing facilities were provided into hoppers connected with the intercepting sewer. The separation and treatment of the sewage should be done in accordance with plans prepared by the State Architect and approved by this Department, as provided by section 14 of the Public Health Law.

It was also noted during the inspection that the water closet located just outside of the principal keeper's office, which is used for dumping the buckets from the condemned cells and as a receptacle for cuspidor wastes, was in a very insanitary condition and was not properly inclosed. This closet is located in close proximity to the kitchens and mess room and should be abandoned.

Privies.— There are two privies inside of the prison grounds used by inmates who work in the yards. One of these privies overhangs the water in the basin and is simply provided with long timber used as a seat. What would be the front and back vertical sides of the vault in an ordinary privy slope toward each other so as to form an opening over the water of about eight inches wide. This construction is intended to prevent prisoners escaping into the river. At the time of the inspection this privy was in a very insanitary condition caused by the lodging of excreta on the sloping sides of the privy. This privy is located about 175 feet from the mess room.

The other privy is located over an abandoned 10-inch sewer near the power house. It is of similar construction to the other privy and is not screened or protected from flies. At the time of the inspection it was partially filled by excreta. It was stated that during the summer this privy is flushed out by means of a hose. It is not possible to flush it out in the winter owing to freezing. Both of these privies should be abandoned and inclosed flush closets should be installed at convenient points in the yard to replace them.

Garbage disposal

Wooden barrels with handles on the sides are provided at the kitchen for receiving the garbage. The barrels are removed from the kitchens daily, but it did not appear that they were washed before they were returned. Some of the garbage is fed to hogs owned by the institution. The hogpens are located north of the northerly prison wall at a considerable distance from the kitchens and mess rooms. The major portion of the garbage is sold. It is placed in an open, shallow concrete tank located near the southeastern corner of the institution inclosure about 150 feet from the kitchen. The tank was full and heaped up at the time of the inspection and gave off characteristic sour garbage odors. It was stated that the garbage is removed from the storage tank daily during the summer and three times a week during the winter. The garbage should be removed daily both summer and winter and the tank should be covered.

The ashes at the institution are used for filling and the rubbish is dumped into the river. At the time of the inspection rubbish and decomposable organic matter were stranded on ice floes in the basin. The rubbish should not be discharged into the river, but should be burned. It is probable that the rubbish could be burned in one of the existing boiler houses or possibly at the power plant now under construction without creating objectionable conditions.

Heating and ventilation

The institution is heated from two power plants at present. These plants appear to be inadequate to provide sufficient heat and power during cold weather and a new central power plant is now under construction and nearing completion. The direct system of heating by steam radiators is used throughout the institution. It is expected that the new power house will adequately heat the prison.

Except in the cell house, main kitchen and hospital, windows are being depended upon entirely for ventilation.

Aside from the cell house the floor and air space of the different buildings, shops and rooms are not less than usually allowed for buildings of this kind, although the per capita floor space in the dormitory is as low as 34 square feet per person the height of the ceiling is nearly 20 feet, which gives an air space of over 600 cubic feet per person. This room appears to have a sufficient number of large windows to give ample ventilation.

Although the installation of the fans in the main ventilating flues of the cell blocks previously described appears to have improved the ventilation of the cell house and cells, as indicated by the absence of dampness on the floors of the cell house and the walls of the cells, the fans are entirely inadequate to properly ventilate the cells. It was only by placing a lighted match in the ventilating opening that any outward movement of air from the cells could be detected. Ventilation to maintain satisfactory conditions requires that not less than 25 cubic feet of fresh air per minute shall be supplied to each person. For the rated capacity of the cell house of 1,200 it would require a fresh air supply of 500 cubic feet per second. This is equal to twice the rated capacity of 24-inch fans of this type under a free discharge and would require a velocity of air of about 30 feet per second through the ventilation pipes. Considering the restricted section of the ventilators, it is probable that the quantity of air discharged by the fans is less than one-quarter of the required amount. Considering the small size of the cells, the inadequate ventilation, the fact that two prisoners are placed in many cells and the use of the bucket system in the cells, I am of the opinion that the present cell blocks are very insanitary and entirely unsuitable for the detention of prisoners who are required to remain in the cells from 14 to 15 hours a day and that the cell blocks should be abandoned, since it would be impracticable to remedy the conditions owing to the need of the construction of toilets and since the heavy masonry construction would make the cost of installing water closets and a proper ventilating system almost prohibitive.

The result of the burning out of the fan in the kitchen flue, previously noted, is that the kitchen is improperly ventilated, and on one of the days

of the inspection the vapors and steam were so dense that an object 20 feet away could scarcely be distinguished. A large institutional kitchen should never be located below another room, but should be placed where ample ventilation through the roof and ceiling by means of a clerestory may be maintained.

Conclusions and recommendations

In view of the conditions found to exist at Sing Sing prison, as pointed out in detail above, I would state in conclusion that the most serious problem is that in connection with the cell blocks of the main cell house due to the small cells, to inadequate ventilation, to the use of the bucket system and to the doubling up of prisoners in these small cells. It appears, however, that owing to the design and massive construction of the cell blocks it would be impracticable, if not impossible, to substantially remedy these objectionable features by remodeling the cell blocks, and I am of the opinion that the cell blocks should be abandoned. Until the cell blocks are abandoned and new cell blocks constructed along more modern lines, there are certain alterations, modifications and additions that could and should be made without delay, and I would make the following recommendations:

1. In view of the inadequacy of the plumbing fixtures in most of the buildings of the prison and to their unsatisfactory type and location in some cases —

   (a) That additional fixtures be provided in all cases where needed, in accordance with the standards indicated in the body of this report.

   (b) That old and obsolete fixtures be replaced by modern sanitary types of fixtures.

   (c) That the water closet in the bakery should be abandoned.

   (d) That outside water closets used for dumping buckets from the condemned cells should either be abandoned or inclosed in a properly lighted and ventilated building.

2. With reference to water supply —

   (a) That the use of the springs and ponds on the prison grounds as a source of water supply be discontinued except for fire protection purposes.

   (b) That the distributing reservoir be covered and surrounded by a proper fence with a locked gate to afford protection against chance or wilful pollution of the supply.

3. With reference to sewerage —

   (a) That provisions be made for the separation and treatment of the domestic sewage of the prison in a suitable sewage disposal plant. Such separation and treatment of the sewage should be carried out in accordance with plans which should be submitted to and approved by this Department, as required by section 14 of the Public Health Law.

   (b) That the place for dumping and airing the night buckets from the main hall be removed to a place farther from the mess hall and kitchen.

   (c) That the two privies in the yard be abandoned.

4. That a new main kitchen of adequate size, properly lighted and ventilated and with cookers and steamers so arranged as to facilitate cleaning the floors, be provided.

5. That the kitchens and mess rooms be screened to keep out flies during the summer.

6. That all refrigerator drains be disconnected from sewers carrying domestic sewage.

7. With reference to the disposal of garbage —

   (a) That the garbage barrels be provided with covers and thoroughly cleaned daily.

(b) That the garbage storage bin be covered and the garbage hauled away daily during both summer and winter.

8. That the rubbish be burned and not dumped into the river.
9. That the manure be removed daily.

Respectfully submitted,

THEODORE HORTON,
Chief Engineer

ALBANY, N. Y., *February* 8, 1915

WATER ANALYSES FOR SING SING PRISON

Nitrogen as —				Parts per Million					B. Coli		
Free ammonia	Albuminoid ammonia	Nitrites	Nitrates	Oxygen consumed	Chlorine	Total hardness	Alkalinity	Bacteria	10 c.c.	1 c.c.	1-10 c.c.
CROTON SUPPLY INLET TO RESERVOIR											
.020	.076	.001	.0160	5.60	3.00	36.40	30.00	160	1+2—	—	—
CROTON SUPPLY NEAR OUTLET TO RESERVOIR											
......	....	.....	.....	....	....	.....	.....	70	2+1	—	—
TAP ON CROTON SUPPLY											
....	....	....	.....	....	....	.....	.....	275	1+2—	—	—
TAP ON SPRING SUPPLY											
.064	.0641	.010	3.00	3.20	7.38	157.2	155.0	1,100	3+0—	—	—

State Farm for Women (Valatie)

HERMANN M. BIGGS, M. D., *State Commissioner of Health:*

I beg to submit the following report on an investigation of the sanitary conditions of the State Farm for Women near Valatie. The investigation was made on January 25, 1915, by Mr. C. A. Howland, assistant engineer.

Location and general description

Location.— Town of Kinderhook, county of Columbia

Capacity.— Inmates, 600; attendants, 36

Present population.— 33 regular inmates and 4 from Great Meadow prison; attendants, 4; total, 41

Class of inmates.— Women over 30 years old convicted of a misdemeanor or offense of lesser character at least five times in two years

Area of grounds.— 319 acres

Number of occupied buildings.— 4

The institution is situated on flat country about half way between Valatie and Niverville. The only nearby water course is Kinderhook creek, which flows through part of the property. There is only one swampy area, which is near the creek, and mosquitoes are said to be numerous near this swamp, but not near the two main buildings, which are some distance from it.

Buildings

General description of buildings.— Of the occupied buildings, one is occupied by the inmates, one by the warden, one by the farmer and a small outbuilding is occupied by three of the four Great Meadow prison inmates, detailed there

to help with the farm work. One building is being prepared for occupancy by the warden, who is temporarily living in a building which will ultimately be occupied by inmates. In addition to these there are barns, sheds and other accessory buildings.

General physical and sanitary condition of buildings.— The buildings occupied by the inmates and the warden are constructed of concrete and of brick covered with stucco. They are of recent construction and in a good state of repair. The interior finish is of wood, wooden floors being laid over the concrete ones. The interior walls of all the buildings at present are of bare plaster, but the inspector was informed that these walls will be tinted by the inmates, which has already been done in a few instances. These buildings were in a clean and sanitary condition.

The barns and stables are not adequate for the needs of the farm and are being used beyond their intended capacity. The overcrowding of the barns and stables increases the difficulty of keeping them in a sanitary condition, and they are apparently not designed in a manner which will best promote proper drainage. The manure is temporarily piled near the stables and is carted away from time to time to a point in the fields between the barns and the main building, but at a considerable distance from the latter.

Water supply

The water for the two main buildings is pumped from driven wells, a separate supply being used for each building. The two wells for the southerly cottage are located about 40 feet northeast of the building in the front lawn near a road and consist of casings of about 1½ inches in diameter driven through the sandy gravel of the region to a depth of about 22 feet. The pipe lines from these two wells pass through a wooden covered valve box and thence to the pump, which is located in the cellar of the building. This pump is of the small cylinder type, the cylinder dimensions being given as 3½x3 inches. At the time of the inspection this pump was running at a counted rate of about 52 strokes per minute, but the inspector was informed that the average rate is from 40 to 50 strokes per minute. At a rate of pumping of 50 strokes per minute, allowing 10 per cent. for slippage, a flow of water of about 20.6 gallons per minute is obtained, and as the inspector was informed that it is necessary to pump for about eight hours per day to provide sufficient water for this building, a total water consumption of about 9,000 gallons per day is indicated. The water is pumped into a closed iron tank located in the cellar and distributed through the building by compressed air pressure in this tank, the pressure at the time of the inspection being 25 pounds per square inch, as indicated by the pressure gauge, but the inspector was informed that about 40 pounds per square inch is usually maintained.

The water supply system for the northern building, which is now occupied by the warden and his family, is the same in every respect as that of the other building, except that only one well has been driven. This well is located on the lawn about 15 feet northwest of the building. The engineer was informed that about two hours' pumping are required daily to furnish the desired amount of water at this building. At the rate of pumping used, in computing the volume of other water supply, a total daily consumption of water of about 2,000 gallons is indicated.

In addition to this supply there is a driven well located near the barnyard about 25 feet in a southerly direction from the main portion of the barn. This well consists of an iron casing about 1½ inches in diameter, which the engineer was informed is driven from 20 to 25 feet through the sandy gravel of the region. A hand pump of the variety commonly called a pitcher pump is used to pump the water which is used for watering stock and for general purposes about the barn. The engineer was informed, however, that the milking utensils are not washed in the water, but are washed at the main building. Since the well is located near the barns and barnyard, it is probably subject to pollution by fecal wastes from domestic animals and occasionally from human sources, since there are no toilet facilities whatever provided at the barn, although the fact that this is a driven and not a dug well probably protects it to some extent from surface wash.

There is also a dug well and pump situated in the rear of the residence which will be occupied by the warden, and this well is about 10 feet from the rear of the house and about 35 feet from a privy which, however, is slightly down hill from this well. Neither this well located at the warden's residence nor the well located at the barn are shown on the plans for a temporary water supply which were submitted to and approved by this Department, and therefore, although they may have been in use on this property for a long period of years before the State acquired it, still their use is in violation of the law.

Samples of the well water used at the northern and southern cottages were collected on February 8, 1915, by Dr. H. J. Noerling, the physician connected with the institution, at the request of this Department, and were forwarded to the Division of Laboratories and Research, being received on February 11, 1915. The results of the analyses are given below:

DATE	Nitrogen as —				Oxygen consumed	Chlorine	Total hardness	Alkalinity	Bacteria	B. Coli		
	Free ammonia	Albuminoid ammonia	Nitrites	Nitrates						10 c. c.	1 c. c.	1-10 c. c.
	WATER FROM WELLS OF SOUTH COTTAGE											
February 8, 1915......	.021	.002	.100	0.20	3.50	2.00	94.20	74.00	160	—	—	—
	WATER FROM WELLS OF NORTH COTTAGE											
February 8, 1915......	.006	.008	.001	1.00	1.00	4.50	32.50	16.00	40	—	—	—

A review of the results of the chemical and bacteriological analyses of the water from these two sources shows that they differ chemically and, to a lesser degree, bacteriologically. The water from both wells shows a certain amount of pollution. In one case, namely, the southern well, this pollution is more active than the pollution in the northern well, due in all probability to the greater amount and greater velocity of pumping of the ground water. Owing to the proximity of both wells to the sewer line, which, as pointed out above, was back-watered from the surcharging of the cesspool below, the pollution of these wells undoubtedly arises from the sewage in the sewer system. So far as danger of pollution under the existing conditions is concerned, it should be pointed out that bacteriologically the water appears to be safe; in other words, the sewage pollution being fairly well purified, especially in the case of the northern well.

Upon the plans originally submitted to this Department for a water supply and sewer system for the two cottages which have been built, such systems being merely temporary expedients, the outfall sewer was shown as passing within a few feet of one of the wells. It was immediately pointed out to the State Architect that such near proximity of a sewer to a well was extremely dangerous and could not be approved by this Department even for the most temporary installations. The sewer line was therefore relocated practically as it has now been built, and the plan as amended was approved as a temporary expedient. The analyses of the water which have been made by the Division of Laboratories and Research now indicate that the water obtained from these wells, especially the wells supplying the south cottage, is polluted by sewage, and while, as pointed out above, this sewage has filtered through the subsoil of the region, yet its effect upon the sanitary quality of the water is apparent and may at any moment become actively dangerous. It is therefore of great importance that immediate steps be taken to permanently prevent the pollution of these water supplies or to obtain the water from a different source which is not subject to pollution. If it is considered necessary, even for temporary use only, to retain the present supplies and to leave the

sewer in its present location, the sewer and house connections should be reconstructed entirely of cast iron pipe with water-tight joints and to extend and modify the sewage disposal plant to provide better purification and prevent back-water.

Plumbing

General type.— The plumbing in all of the buildings of the institution where it has been installed is of recent construction and therefore modern and of the open type. Although the inspector investigated the plumbing in detail, it will not be necessary to describe minutely the different features, since the inspector found that the plumbing is evidently satisfactory. Data gathered at the time of the inspection also show that a sufficient number of fixtures are provided for the use of the inmates.

The cottage to be occupied by the warden when the remodeling is completed has recently been provided with a flush closet and other modern plumbing fixtures which are apparently satisfactory.

Sewerage and sewage disposal

The roof water leaders of the main buildings, the inspector was informed, discharge into cesspools located near the buildings, and these storm water cesspools are said to be 10 to 12 feet deep and 6 to 8 feet in diameter, constructed with uncemented stone walls. These cesspools are covered by earth, and for this reason it was not practicable at the time of the investigation to inspect them, but the inspector was informed that no trouble has been experienced with overflowing of the cesspools.

The sanitary sewage of the two main buildings is discharged into a sewer which passes in a northeasterly direction about one-quarter mile to a cesspool located in the fields at a point where the ground begins to slope to a ravine which leads to Kinderhook creek. Plans were approved by this Department on December 9, 1912, for sewage disposal works for these two cottages, and on these plans a 6-inch sewer is shown extending in a direction practically as it has been built to a cesspool. Also, two gravel beds are shown by the plans, it being intended that the sewage not absorbed by a subsurface system of tile pipes would discharge onto these beds, the flow onto each of the two beds being controlled by a valve.

At the time of the inspection it was found that the sewage had overflowed the ground adjacent to the cesspool after rising in the cesspool to such a height that the frozen scum and sewage had raised the iron manhole cover of the cesspool several inches. At the manhole next above the cesspool it was found that the sewage had risen to a level estimated to be about that of the top of the cesspool, and there was danger that the sewage would back up into the fixtures of the buildings. An inspection of the surrounding territory did not reveal any indications of auxiliary disposal works such as are shown on the plans approved by this Department, and inquiry of persons at the institution would seem to indicate that the plans have not been followed out. While no investigations of an extended nature which would involve excavations were conducted, and the ground at the time of the inspection was covered with snow, ice and frozen sewage which interfered with even a superficial observation, yet it appears that the complete disposal plant has not been constructed.

As stated above under another caption, modern plumbing fixtures have recently been installed in the warden's residence, and consequently some method of disposal of the sewage from this building will have to be devised. An outside privy stands in the rear of the building about 30 feet from a well, but slightly downhill from the well. The privy showed signs of having been recently used, and it was assumed that three of the Great Meadow prison inmates who sleep in a nearby outbuilding had used it. There is also a privy located on the edge of a precipitous bank near the farmhouse occupied by the farmer and his family. This privy was in need of repair at the time of the inspection. In regard to the disposal of fecal wastes from the barns and stables, exclusive of the manure from the live stock, there is apparently no

provision made for the collection of human excrement and its subsequent disposal, although persons are employed there in husking, milking and caring for the live stock, and consequently the method employed is the one insanitary method common under such conditions.

Garbage disposal

The garbage is stored in an uncovered half barrel, and the inspector was informed that it is removed every day and disposed of by feeding to hogs. The refuse is dumped about one-half mile from the cottages and the ashes are also dumped in the same place except when they are used for grading.

Heating and ventilation

Heating.— The heating of the several buildings is by separate steam plants, the direct system being used and appeared to the inspector to be satisfactory.

Ventilation.— No separate system designed for ventilation alone is provided to ventilate the inmates' rooms, but the necessary renewal of air is accomplished through the window in each room and through transoms over the doors. These transoms are without sashes and are barred by a grille work of wire. The rooms are on each side of a central hall having windows at the ends and also ventilators, one shaft being located on each side of the windows. A register with dimensions of about 1½x2 feet, which may be closed by means of chains provided for that purpose, is located on either side of the window, one near the ceiling and one close to the floor. The corridor may therefore be ventilated from a point near the bottom or a point near the top or from both points. No means of forcing a draft through these ventilating shafts is provided, but the shafts are connected with the outer air through the roof. It appeared to the inspector that the ventilation thus provided, assuming that care is taken to use it so as to obtain the maximum benefit, should be adequate for the building.

Milk

The milk of the institution is obtained from its own herd of cows. The conditions under which the milking is done are not satisfactory, since the cow stable is overcrowded and the conditions are insanitary; and although a well with a hand pump is situated near the barn, the facilities for insuring cleanliness of the milk and milking utensils are not adequate, and no milk house is provided. The inspector was informed that the milk pails are cleaned at the main building and after milking the milk is taken in them directly to the main building.

Conclusions and recommendations

Although the two principal buildings of this institution are nearly built, and consequently in many respects are not open to criticisms, yet there are a number of conditions which are in need of improvement. Among the more important of these is the matter of the proper disposal of sewage from the two main buildings. The observations made during the inspection indicate that the sewage disposal plant has not been constructed in accordance with the plans approved by this Department. The vital importance of this is obvious.

I therefore beg to make the following recommendations:

1. That the sewer from the main buildings and the building connections be entirely constructed of cast-iron pipe with water-tight joints, or that some other source of water supply not subject to pollution be developed.
2. That the sewage disposal works be revised and extended to conform with the plans approved by this Department.
3. That a proper method of disposing of the sewage from the warden's residence be designed and built. Plans for such a system should be submitted to this Department for approval, as well as plans for the water supplies which it is proposed to use at this place and for other buildings.

4. Adequate toilet facilities and better means for personal cleanliness among the workers should be provided at the barns.

5. That all outside privies be discontinued wherever practicable. Where it is necessary to maintain an outside privy, such privy should be well built, should be screened from flies and should have pails for the excreta to be removed and the excreta disposed of frequently in a sanitary manner.

6. That greater precautions be exercised in milking to insure greater cleanliness of the milk, milking utensils and the barn and surroundings, and that as soon as practicable better and more sanitary quarters, including a milk house, and better facilities be provided for the production and care of the milk and the proper washing of utensils.

7. That the stables be kept in a more sanitary condition and the manure be more promptly removed and properly disposed of.

8. That the garbage be stored, collected and removed daily in covered receptacles.

Respectfully submitted,

THEODORE HORTON,

Chief Engineer

ALBANY, N. Y., *February* 25, 1915

OTHER STATE INSTITUTIONS

State Institution for the Study of Malignant Diseases (Buffalo)

HERMANN M. BIGGS, M. D., *State Commissioner of Health:*

I beg to submit the following report on an investigation of sanitary conditions at the farm of the State Institution for the Study of Malignant Diseases of Buffalo, located at Springville. An inspection was made of the farm by Mr. C. M. Baker, assistant engineer, in connection with an inspection of the institution made on March 4 and 5, 1915.

The institution proper is located in the city of Buffalo. The buildings are all modern structures, well cared for and adequately equipped. Water is obtained from the mains of the city and the sewage is discharged into the city sewer system. The institution proper, being situated in the city of Buffalo and therefore supplied with city water and served by the city sewer system, is more or less subject to the influence of the general sanitary condition of the city; and since no unsatisfactory conditions were observed about this part of the institution, this report will cover only the results of the investigation of the sanitary condition of the farm at Springville. The farm maintained in connection with the institution is located near the village of Springville, about 30 miles southeast of Buffalo.

This farm is located about three-quarters of a mile north of the village of Springville. The improvements consist of a bungalow and a few poultry houses. It is planned with the development of the institution to locate an experiment station with fisheries at this place.

The water supply is derived from a spring from which the water flows to a hydraulic ram which in turn forces water to the buildings. The spring is located on the south side of a gravelly knoll, on either side of which flows a small brook, there being only a narrow neck of land between the brooks and connecting the knoll with the mainland. The distance between the two streams or across the knoll is only about 80 feet. A dam located in the southern stream slightly above the spring causes an artificial lake, the surface of which is 5 or 6 feet above the elevation of the spring, but it was stated that the spring existed before the construction of this lake. The other stream, that is, the one flowing to the north of the spring, flows through a barnyard about 500 or 600 feet northwest of the knoll. The elevation of the bed of this stream directly opposite the spring is about the same as the elevation of the spring, but farther upstream is, of course, somewhat higher. The area of the knoll is insufficient to furnish the water supplying the spring, and the spring is therefore supplied from the general flow of ground water which finds its way through the narrow neck of land and also, possibly, to some extent from the stream to the north. The ground water tributary to the spring is probably polluted from the barnyard and farmhouse mentioned above, as these buildings are apparently in the direct flow of the ground water which would naturally find its way to the spring. Located on the neck of land connecting the knoll with the mainland is a small summer house, to the rear of which is a privy provided with a removable vault. The distance of this building is about 50 feet from the spring. The house is occupied part of the time during the summer. The close proximity of these premises to the spring offers sufficient opportunity for pollution of the water providing proper sanitary conditions are not maintained at all times. The spring is inclosed and covered by a concrete house, the door of which is kept locked. A high woven wire fence on the west boundary of the institution property is about 20 feet from the spring. Adequate protection is provided from surface drainage.

The assistant engineer was not provided with containers for collecting sam-

ples at the time of his inspection. Containers were sent later to Dr. Gaylord, however, who has collected samples and sent them to the Division of Laboratories and Research for analyses, the results of which are as follows:

SOURCE	Tap at bungalow	Tap at bungalow	Directly from spring	Pond above dam	Creek to northwest of spring
Color	Trace	Trace	....	....	....
Turbidity	Clear	Clear	....	....	....
Odor, cold	1 vegetable	1 vegetable	....	....	....
Odor, hot	1 vegetable	1 vegetable	....	....	....
Solids, total	163	153	....	....	....
Loss on ignition	13	7	....	....	....
Mineral residue	150	146	....	....	....
Ammonia, free	.002	.002	....	....	....
Ammonia, albuminoid	.002	.002	....	....	....
Nitrites	.002	.001	....	....	....
Nitrates	4.00	3.00	....	....	....
Oxygen consumed	1.00	0.40	....	....	....
Chlorine	2.00	2.50	....	....	....
Hardness, total	142.8	140.0	....	....	....
Alkalinity	133.0	138.0	....	....	....
Bacteria per c. c.	....	10	20	100	1,900
B. coli type 10 c. c.	....	0+3—	0+3—	2+1—	3+0—
B. coli type 1 c. c.	....	0+3—	0+3—	1+2—	1+2—
B. coli type 1/10 c. c.	....	0+3—	0+3—	0+3—	0+3—

The results of the chemical analyses of the spring water indicate a water of satisfactory physical qualities, low in free and albuminoid ammonia and nitrites. The figures of 4.00 and 3.00 for nitrates and also of 2.00 and 2.50 for chlorine are high and are probably considerably above the normal. The bacterial analyses show bacterial contents of 10 and 20 per c. c. with the B. coli type absent. It thus appears from the analyses that pollution is finding its way into the ground water supplying the spring, as is shown by the high nitrates and chlorine, but the low figures for the ammonia and nitrites and also the low bacterial content indicate that the water has been well purified in its passage through the soil. It is possible, however, that under different hydraulic conditions of the ground water or at a different season of the year this purifying effect of the soil may be ineffective and contamination may thus become active and dangerous.

In view of these facts, analyses should be made of the water from time to time to detect the existence of any active contamination. The sources of the stream described above are apparently springs, and if there are springs located above the barnyard, from which it is assumed pollution finds its way into the institution spring, a comparison of analyses of the water from these springs and the spring supplying the institution would more definitely determine whether the high nitrates and chlorine were entirely due to pollution from the barnyard or whether the natural amount of nitrates and chlorine in the ground water in this locality is more than would naturally be expected. In any event, it seems essential that under existing conditions a close bacterial control should be maintained of the water supply, for, as pointed out above, the contamination which is apparently present may at almost any time become active and dangerous. On the other hand, it is possible that the purifying effect of the soil will be sufficient to protect the supply from active contamination for some time, thus making it unnecessary to develop a new supply at present, as will be necessary if the supply becomes dangerously contaminated. Another consideration in connection with the protection of the supply is the maintenance of sanitary conditions in the vicinity of the summer house near the spring, also about the barnyard and premises previously mentioned, and therefore the institutional authorities should use their influence as far as possible to have proper sanitary conditions maintained at these places.

The sewage from the bungalow is disposed of by means of settling tanks and subsurface drains. The inspection was made during the winter with snow on the ground and, in fact, at a time when the sewage disposal plant had not been in use for some time. Therefore the conditions which would be obtained with the plant in operation could not be observed. No complaint was offered, however, regarding the operation of the system, and, in fact, it was stated that the disposal plant had very satisfactorily cared for the sewage.

Neither in the case of the sewage disposal works nor the water supply system have plans been submitted to this Department for approval, as required by section 14 of the Public Health Law.

Satisfactory disposition is made of what little garbage is collected at the farm, and since there are no inmates at the farm, questions of sanitation regarding heating, ventilation and milk supply do not arise.

As a result of this investigation I beg to submit the following recommendations:

1. That the institution authorities use their influence as far as possible to have sanitary conditions maintained at all times about the summer house near the spring and the farm located 500 or 600 feet northwest of the spring.

2. That the institution make or have made frequent analyses of the spring water to detect the existence at any time of active contamination.

3. That should active contamination at any time be found present a new supply of a satisfactory quality be developed.

Respectfully submitted,

THEODORE HORTON,

Chief Engineer

ALBANY, N. Y., *June 29, 1915*

Farmingdale Agriculture School (Farmingdale)

HERMANN M. BIGGS, M. D., *State Commissioner of Health*:

I beg to submit the following report on an investigation of the water supply of the Farmingdale Agricultural school located near Farmingdale, Long Island. An inspection was made of this supply by Mr. [illegible], assistant engineer, on May 23, 1915.

The institution is situated about two miles northeast of the village of Farmingdale, L. I. There is as yet no student population since the buildings are now only under construction. It is planned, however, to receive students in the fall of 1915 at which time it is estimated that the population will be about 200. The ultimate population of the institution is estimated at [illegible].

Plans for the water supply, sewerage and sewage disposal at this place were approved by the Department on July 6, 1914 and according to the report on the approval of these plans "the supply is to be obtained from 6-inch wells located near the power house in the northwestern portion of the property. The water is to be raised from the wells by means of air lifts and discharged into a concrete reservoir having a capacity of about 30,000 gallons. From this reservoir the water is to be pumped directly into the main distributing system, consisting of pipes varying in size from 4 to 8 inches in diameter. The surplus water will be pumped into an elevated tank about 40 feet high located on the hill about 60 feet above the general level of the ground of the institution."

At the time of the inspection the standpipe had been constructed and some of the mains laid. One 6-inch well had been driven and was connected with a small pump operated by a gasoline engine. The capacity of the pump, however, was insufficient to test the flow or capacity of the well. This well is driven to a depth of about [illegible] feet. Water was encountered at a depth of 22 feet. The strata through which the well passes are as follows: 0 to 22

feet, sand and coarse gravel; 10 to 20 feet, sand and fine gravel; 20 to 40 feet, coarse gray sand; 40 to 50 feet, yellow clay and gravel; 50 to 65 feet, drab clay and fine sand; 65 to 80 feet, blue clay and sand; 80 to 106 feet, gray sand; 106 to 111 feet, cream colored sand. The well is located about 300 feet west of the power plant, and is thus further from the sewer mains than was indicated on the original plans submitted for approval.

At the time of the inspection the contractor constructing the power plant had erected a privy for the workmen about 200 feet from the well. This was in an unsatisfactory condition and, in fact, should in any case be located at a much greater distance from the well.

An inspection was also made of other wells now being used at the institution. Two of these wells were constructed by the contractors and are being used by their workmen. The superintendent requested that analyses be made of the water from them, as he thought it possible that they would not be abandoned when the contractors had completed their work, but would be continued in use by the institution. Other wells inspected include those that are being used by the present officers of the institution.

The contractors' well located near the power house is 1¼ inches in diameter and is driven to a depth of about 35 feet. It is equipped with an iron pump operated by a gasoline engine. A shed containing the pump and engine was located directly over this well. There was considerable manure in the vicinity of the well and a privy with an earth vault is located about 90 feet from it. A similar well is located near the horticultural building and is subject to similar sources of pollution, except that no manure was noticed about it. The well located at the building now used for offices is a dug well and is about 40 feet deep. It is covered with a wooden platform and provided with an iron pump operated by a windmill, which forces the water into an elevated tank. An old cesspool which, however, has been abandoned for about one year is located about 30 feet from the well. The barn is about 50 feet distant and the present cesspool about 150 feet. The other well inspected is located in the woodshed at the rear of a house just across the road from the office building. This is a dug well about 40 feet deep and is provided with a chain and bucket for drawing water.

Samples of water were collected from the main well after the pump had been in operation for about 40 minutes, also from each of the other wells, and sent to the Division of Laboratories and Research for analyses, the results being given in the appended table.

The results of the analyses of the water of the main well indicate a water satisfactory in physical quality except for the high turbidity, which is due to very fine sand being drawn up with the water. It is probable, however, that when the well is put in constant use this difficulty will eventually disappear. Regarding the sanitary condition of this water, the analyses show that at the time of the inspection there was a very small amount of nitrogenous matter present; the chlorine content was four parts per million, which is not above the normal; the bacterial content was 325 per c. c., which, although rather high for a well supply, possibly is not excessive considering the fact that the well had not been in operation for some time prior to the time of collecting the sample, thus allowing opportunity for the accumulation of pollution in the pipe and pump of the well, and organisms of the B. coli type were not present.

In view of the results of the above analyses and from a study of the general conditions surrounding the well, it is apparent that at the time of the inspection the water from this well was of a satisfactory sanitary quality. However, it would seem advisable to have the contractors' privy, described above, removed a greater distance from the well. The matter of pollution of the wells furnishing the water supply is taken up to some extent and discussed in the report on the approval of the plans. The possibility of the water becoming polluted from sewers to be constructed in the neighborhood of the well was pointed out and the plans were therefore approved upon the following conditions:

1. That the sewer between manholes I and K and all connections with this sewer between these points shall be constructed of cast iron pipe with lead joints.

2. That no sewage or sludge from any part of the sewage disposal works shall be discharged into any watercourse or body of water or at any point within a distance of 1,000 feet from the wells furnishing the water supply for the Agricultural school.

It would seem that if these precautions are carried out and adequate care otherwise taken at all times to prevent pollution from finding its way into the wells, they should furnish a satisfactory supply.

The results of the analyses of the water from the contractors' well near the power house indicate that the water is satisfactory in appearance and show comparatively low values for free and albuminoid ammonia and nitrites. However, the figure of 0.50 for nitrates and that for chlorine of 5.50 are somewhat above normal. The bacterial content of 40 per c. c. is low, and the B. coli type was not found present. The high nitrates and chlorine indicate that pollution has found its way into the ground water supplying the well, but the small amount of nitrogenous matter in the form of ammonias and nitrites and also the low bacterial content indicate that the water had been well purified in its passage through the soil. Although no complete chemical analyses were made of the water taken from the contractors' well located near the horticultural building, the analysis for chlorine showed that it is considerably above the normal and the bacterial content of 200 per c. c. is high; and it is therefore probable that this supply is also receiving pollution, but the absence of organisms of the B. coli type indicates that the pollution was not of a dangerous character at the time of the inspection. The results of the analysis of the water taken from the well near the office building likewise show high chlorine and a high bacterial content, and it is quite probable that this water is also somewhat polluted, although it was not actively contaminated at the time of the inspection. The existence, however, of even inactive pollution in the wells is a source of potential danger, since at certain seasons of the year, when the flow of ground water is at a maximum, or at times of heavy drafts on the wells, causing a ground water flow greater than the normal over a certain area, it is possible that the purifying effect of the soil will be insufficient to prevent active and dangerous contamination of the water.

It is evident from the analysis of the water taken from the well located in the rear of the building just across the road from the offices that this water is actively and dangerously contaminated. This is shown by the high figure, 9.00 parts per million for chlorine, which is double the normal for this locality; also by the high bacterial content, 650 per c. c., and the presence of the B. coli type in all the 10 c. c samples and in one each of the 1 c. c. and the 1/10 c. c. samples.

It is thus apparent from this investigation that the proposed water supply, the source of which is to be driven wells, in the locality of the main well which was inspected in connection with this investigation, should furnish a satisfactory supply of water providing care is taken at all times to prevent sources of pollution in the immediate vicinity of the wells. Regarding the other wells now being used, it is apparent that they are all receiving more or less contamination, although only one of them showed active contamination.

In view of these facts I beg to submit the following recommendations:

1. That the institutional authorities take steps to have the contractors' privy, now located within about 200 feet of the main well, removed to a greater distance and that it be maintained in a more satisfactory condition.
2. That the institutional authorities carry out the recommendations embodied in the report on the approval of the plans for water supply, sewerage and sewage disposal.
3. That the contractors' well now in use be not used by the institution as a part of its supply.
4. That the institutional authorities abandon the wells at the office building and the building across the road and provide safe supplies instead.

Respectfully submitted,

THEODORE HORTON,

Chief Engineer

ALBANY, N. Y., *June* 21, 1915

WATER ANALYSIS FOR FARMINGDALE AGRICULTURAL SCHOOL

Source	Main well	Contractors' well near power house	Contractors' well near horticultural building	Well at building being used for office	Well at house across road from office
Collected on	5/13/15	5/13/15	5/13/15	5/13/15	5/13/15
Color	Trace	Trace	....	....	....
Turbidity	75	Clear	....	....	....
Odor, cold	1v.	1v.	....	....	....
Odor, hot	1v.	1v.	....	....	....
Solids, total	148	71	....	....	....
Loss on ignition	8	8	....	....	....
Mineral residue	140	65	....	....	....
Ammonia, free	.002	.002	....	....	....
Ammonia, albuminoid	.006	.026	....	....	....
Nitrites	.001	.003	....	....	....
Nitrates	0.04	0.50	....	....	....
Oxygen consumed	0.90	0.60	....	....	....
Chlorine	4.00	5.50	8.00	5.00	9.00
Hardness, total	14.30	9.50	....	....	....
Alkalinity	10.00	6.00	....	....	....
Bacteira per c. c.	3.25	40	250	500	650
B. coli type, 10 c. c.	0+3—	0+3—	0+3—	0+3—	3+0—
B. coli type, 1 c. c.	0+3—	0+3—	0+3—	0+3—	1+2—
B. coli type, 1/10 c. c.	0+3—	0+3—	0+3—	0+3—	1+2—

Fire Island State Park (Fire Island)

HERMANN M. BIGGS, M.D., *State Commissioner of Health:*

I beg to submit the following report on an investigation of the sanitary conditions at Fire Island State park, Fire Island. An inspection was made of this place on August 20, 1914, by Mr. C. M. Baker, assistant engineer.

Location and general description

Location.— Fire Island, town of Islip, county of Suffolk

Number of visitors.—Average for period of about three weeks during the summer, 300 per day. At one time 600 or 700 people were present on the grounds

Area.— 118 acres

Number of buildings.— 8

Site of park.— The park is situated on Fire Island beach and extends from Great South bay across to the Atlantic ocean. It is located about four miles from Fire Island inlet, adjacent to the Fire Island Lighthouse reservation.

Buildings

The buildings consist of the superintendent's residence, commissioners' building, bathing pavilion, refreshment stand, toilets and three rest pavilions, all of which are of recent construction and in satisfactory condition. They are all wooden structures and the majority of them are located near the bay.

Water supply

Plans for water and sewage disposal were approved by this Department in 1912 (volume 33, page 446, annual report). The main supply, for which plans were approved, consists of a sheeted dug well located near the center of the island about 800 feet from the sewage disposal plant. Over the well is an elevated tank with a capacity of about 3,500 gallons, into which the water is pumped from the well by means of a gasoline engine. The water is then distributed about the grounds by gravity through 3-inch cast iron and 1½-inch galvanized iron mains.

The effect of the operation of the sewage disposal plant upon the quality of the water supply was considered a somewhat indeterminate factor at the time the plans were approved, and as the question could be decided only by means of water analyses after the well had been in service for some time, the following suggestions or limitation was made at the time the plans were

approved as a means of determining the possibility of pollution from the sewage disposal:

"The only effective and safe way of doing this would be to sink a test well on the direct line between the proposed water supply well and the larger sewage disposal plant, the position of which test well should be from one-quarter to one-third the distance from the well to the disposal plant. The well should be at such a depth as to enable samples of water to be secured from the upper level of the ground water. Samples should be collected and analyzed by the Park Commission at frequent intervals during the summer, starting immediately following the putting of the disposal plant in operation, and if any question of pollution is indicated in this test well and before this pollution could reach the main well, the latter should be abandoned and a new one selected at a greater and safer distance from the sewage disposal plant."

At the time of the inspection a driven well equipped with a pitcher pump was located between the main well and the sewage disposal plant about 175 feet from the former, but so far as could be learned by the inspector no analyses had been made of the water. The water from this well, however, was being used by the visitors for drinking purposes, it being located conveniently near one of the pavilions. A wooden platform was built about the well and the drainage from the pump running from the platform to the ground would naturally find its way into the ground water and thus be apt to contaminate the well. It is possible that this well was constructed for the purpose of detecting pollution in the ground water from the sewage disposal plant in accordance with the suggestion given above. If such is the case it should be protected by a suitable inclosure and used for that purpose only, the public being prohibited from it entirely. In any event, such a well is unsatisfactory as a public supply and as such should be abolished.

Although the main well is protected from visitors by a house located over it, in which the pump is located, it would seem that, in view of the fact that the water is practically a surface supply, the depth of the well being only four feet, more adequate protection should be provided by means of a suitable fence inclosing a sufficient area, not less than 100 feet square, about the well.

Samples of the water were taken from each of the wells and sent to the Division of Laboratories and Research for analyses. The results were as follows:

Water Analysis for Fire Island Park

		Tap, main supply	Well, located near central pavilion
Color		Trace	Trace
Turbidity		Clear	Clear
Odor, cold		1v.	1v.
Odor, hot		1v.	1v.
Solids, total		113	55
Loss on ignition		20	19
Mineral residue		93	36
Ammonia, free		.004	.002
Ammonia, albuminoid		.006	.004
Nitrites		.002	.001
Nitrates		0.16	.024
Oxygen consumed		0.90	0.60
Chlorine		24.50	15.75
Hardness, total		40.30	14.30
Alkalinity		30.00	3.00
Bacteria per c.c.		5,600	10
B. coli type	10 c.c.	3+0—	0+3—
	1 c.c.	1+2—	0+3—
	1/10 c.c.	0+3—	0+3—

Results are expressed in parts per million. + Present — Absent.

Abbreviations used to describe odors of water: 0, none; 1, very faint; 2, faint; 3, distinct; 4, decided; 5, strong; 6, very strong; a, aromatic; d, disagreeable; e, earthy; f, fishy; g, grassy; m, musty; v, vegetable.

The results of the analyses of the water from the main supply indicate 113 parts per million total solids, 93 mineral residue, 40.30 total hardness and 30.00 alkalinity, while the corresponding figures for the water taken from the driven well near the central pavilion are 55, 36, 14.30 and 3.00, respectively. The difference in these figures indicates waters entirely different in character, which is probably due to the fact that there is a greater draught on the main well, thus causing the water to be drawn from a different strata. The bacterial results of the analyses of the water from the main supply show the presence of 5,600 bacteria, with those of the B. coli type present in quantities as small as 1 c.c., and thus indicate active contamination. The distance of the sewage disposal from the water supply and the character of the soil would render unlikely any contamination from this source, and it would therefore seem that the pollution occurs largely, if not entirely, from the surface sources, which have previously been mentioned in connection with protecting the well from trespassers. If the contamination that is indicated in the main supply exists normally it cannot be considered safe, but in view of the fact that only the one analysis is available and that the contamination may be accidental and temporary, it is apparent that the actual quality of this supply can be determined only by additional analyses, and it is therefore suggested that the Department make a further investigation, with especial reference to the water supply, as early in the coming season as is practicable.

Although the number of visitors at the park has been more than double that anticipated at the time the water supply was planned, it is apparent that the quantity of water has been sufficient.

Plumbing

The plumbing consists only of that provided in the toilets and was recently installed under the direction of the State Architect. It was found satisfactory at the time of the inspection. At the main toilets five seats are provided in the women's division and three seats and two urinals in the men's division. At the bathing pavilion one seat is provided in the women's toilet and one seat and one urinal in the men's.

In view of the fact that the present facilities were planned for a maximum number of visitors per day estimated at 200, and since the actual number present has on certain occasions been three times that number, with an average for some considerable period much in excess of it, it would seem that additional facilities should be provided, the need of which seems to be recognized by the fact that a privy has been consstructed for the use of the public on the south side of the grounds.

Sewerage and sewage disposal

As mentioned above, the plans for the sewage disposal have been approved by this Department. The main disposal plant which cares for the sewage from the main toilets described above consists of a cesspool and subsurface drainage, while the two toilets in the bathing pavilion discharge each into separate cesspools. It was apparent that the systems were operating satisfactorily at the time of the inspection, but there were then only a few people on the grounds. However, information obtained upon inquiry indicated that, although the number of people visiting the park has at times been far in excess of that for which they were designed, no trouble has been experienced in the operation of the disposal plant. This, however, is probably due partly to the fact that privies have been provided which, to some extent, relieve the load on the disposal plants and partly because the duration of the excessive load has been comparatively short. The fact that no trouble has been experienced does not necessarily indicate that the sewage disposal plants will continue to operate as satisfactorily as they have in the past. On the contrary, it would seem that, in view of the increased number of visitors and the probability that this number of visitors will continue to increase, the reverse would be true and therefore that additional disposal should be provided.

At the time of the inspection a privy located toward the south side of the ground about 350 feet from the Atlantic ocean and between 400 and 500 feet from the wells was being used. No vault is provided, but the inclosure extends to the ground and the dejecta collects on the surface of the ground. The inspector was informed that the fecal matter is occasionally covered with sand. Another privy similarly constructed is provided at the superintendent's residence. This method of sewage disposal was not indicated on the plans which were approved by this Department and is unsatisfactory. If more toilet facilities are needed, as they evidently are, plans for some adequate and satisfactory method of disposing of the sewage from them should be submitted to and approved by this Department.

Since it is apparent from this investigation that certain unsatisfactory conditions exist at Fire Island State park, I beg to submit the following conclusions and recommendations:

Conclusions and recommendations

1. That, in regard to water supply —
   (a) Since the information now available is inadequate to satisfactorily judge the character of the water, more analyses and a further investigation should be made.
   (b) Because of the possibility of contamination of the water supply from surface pollution, due to visitors in the vicinity of the well, the authorities in control of the park provide a suitable fence inclosing an area, not less than 100 feet square, about the well furnishing the main supply and that visitors be excluded from this area; also that a suitable inclosure be provided about the test well and that its use by visitors be prevented by locking the pump.

2. That, in view of the large number of visitors in excess of the maximum number for which the toilet facilities were designed, and the apparent inadequacy of these facilities, as is indicated by the fact that certain privies have been constructed evidently to relieve these conditions, the present plumbing facilities be increased to accommodate the maximum number of people.

3. That additional sewage disposal be provided to care for the increased amount of sewage and the additional toilet which should be provided as indicated above.

4. That all privies be abolished and that when more toilets are needed plans for some adequate and satisfactory method of disposing of the sewage from them be submitted to and approved by this Department.

Respectfully submitted,

THEODORE HORTON,
Chief Engineer

ALBANY, N. Y., *April* 21, 1915

New York State School of Agriculture (Morrisville)

HERMANN M. BIGGS, M.D., *State Commissioner of Health:*

I beg to submit the following report on an investigation of the sanitary condition of the New York State School of Agriculture at Morrisville. This institution was visited and inspected by Mr. C. M. Baker, assistant engineer, on October 13, 1914.

Location and general description

Location.— Village of Morrisville, county of Madison
Present enrollment.— 150

Class of inmates.— Students in agricultural courses
Area of grounds.— 200 acres
Number of occupied buildings.— 10
Site of institution.— The institution is located in the village of Morrisville, Madison county. Morrisville is situated in the valley near the head of the west fork of the Chenango river and is about two miles west of the nearest station on the Oswego branch of the Ontario and Western railroad. The institution is about 15 miles south of the city of Oneida. The surrounding country is hilly, ranging in elevation from about 1,325 feet above sea level at the institution to approximately 1,700 feet on some of the nearby hills. Wooded areas cover some of the hills. The soil is loam, with a subsoil of gravelly loam overlying a shale formation, and with an occasional outcrop of limestone. Situated as the institution is near the center of an extensive farming region, the location is well selected for an agricultural school.

Buildings and grounds

General description of buildings.— The institution owns a farm of some 200 acres, on which are located about 20 buildings, including Bicknell and Madison halls, director's residence, wood and forge shop, horse barn, bath house, two teachers' cottages and greenhouse, all of which are located in a group near the center of the village and fronting on the principal street. Further back or to the south some 700 or 800 feet from these are the farm buildings, including a dairy barn, poultry building, demonstration building, piggery, etc. The buildings are for the most part constructed of wood, except Bicknell hall, which is a fireproof brick structure.

General physical and sanitary condition of buildings and grounds.— The general condition of the buildings and grounds appeared to be satisfactory at the time of the inspection. Some of the laboratories and class rooms, however, appear to be somewhat overcrowded, a condition which will be described more in detail later in this report.

Water supply

The water supply of the institution was investigated in 1910. (See volume 32, page 748, annual report, State Department of Health.) At that time the institution was deriving its supply principally from a spring located nearly a quarter of a mile from the buildings. Water from the village mains, however, was also being used at times. Due to the somewhat unsatisfactory condition of the spring supply the institution during the last two years has been deriving nearly all its water from the village mains, but since the village supply appears to be insufficient to meet the requirements of the institution in addition to its own demand, plans have recently been submitted to the Department of Health and approved for the improvement and development of the spring supply.

The general condition of the spring at the time of the inspection was as follows: It is located about 2,000 feet north of the institution near the northern edge of the village and is situated on the side of a hill at an elevation of about 40 feet above the road and neighboring buildings. The drainage area consists of about 20 or 25 acres and is so located and the topography is such that the surface water must divide about one-quarter of a mile back of the spring and flow on each side of it to the creek below. Farther back of this area are woods, there being no houses for a distance of about a mile, and they are so situated that the drainage from them is in another direction. About two acres of land in the immediate vicinity of the spring is owned by the State and inclosed by a woven wire fence recently constructed. To the east and up the hill from the spring is a pasture in which stock were grazing. A lane is also located along the north boundary of the State property. It was evident from the condition of the spring and the ground nearby that stock had been allowed to wander unrestricted about the springs prior to the time of the construction of the fence now inclosing the area. The northern portion of the drainage area is a cultivated field. The land about the spring, including the pasture, is owned by the director of the school, who informed the inspector

that the pasture is to be plowed and seeded and will be used in the future as a meadow. With this protection, or even with proper ditching to carry the pasture drainage around the spring, the water furnished from this source should be satisfactory in quality, there evidently being no other pollution. Prior to the time of the inspection the spring had been noticeably neglected, but, as stated above, plans have been approved for the improvement of this supply. The yield of the spring has been estimated at 15,000 gallons per day and the consumption of the institution at 7,000 gallons per day. It is thus probable that this source should furnish sufficient water for the institution.

The plans for improvements provide for a 3-inch cast iron main leading from the spring to the reservoir located near the spring at an elevation of about 80 feet above the institution grounds. The reservoir is to be constructed of concrete and will have a capacity of about 90,000 gallons. It is uncovered and is to be surrounded by a pipe railing attached to the walls of the structure. The main from the reservoir to the institution is to be a 4-inch cast iron pipe. The approval of the plans states that "the spring if properly protected from pollution should furnish a water supply of satisfactory quality and one that should be adequate for the present needs of the institution and allow for a reasonable increase in the attendance at the school in the future. The institutional authorities, however, should be advised to take special precautions to protect the spring supply from incidental, accidental or wilful contamination during the construction of the pipe lines and reservoir and that it might be well to use the village supply for potable purposes until after the completion of the proposed water supply system."

The village supply, which is to be used as an auxiliary supply, is taken from a reservoir about one mile west of the village formed by a dam across a ravine and is fed by springs, the elevation of the reservoir being about 200 feet above that of the village. The drainage area, which might contribute surface water to the reservoir, consists of about 100 acres of meadow land on which there are no buildings. About 15 acres of this land in the immediate vicinity of the reservoir is owned by the village. There are, however, two roads passing through the drainage area, one to the northwest and the other to the southwest of the reservoir. Ditches are provided to protect the water supply from surface drainage from the former, and the latter is a crossroad on which there is very little travel. Signs are also posted about the reservoir to prohibit trespassing. During the past few years there has been some trouble caused by a fishy odor and taste, which is probably due to algae growths.

Samples of water were taken from both the institution spring and the village supply and sent to the Division of Laboratories and Research for analysis. The results, together with the result of one previous analysis, are recorded below:

DATE	NITROGEN AS —				Oxygen consumed	Chlorine	Total hardness	Alkalinity	Bacteria	B. COLI		
	Free ammonia	Albuminoid ammonia	Nitrites	Nitrates						10 c. c.	1 c. c.	1-10 c. c.
INSTITUTION SPRING												
November 23, 1910....	.006	.026	Trace	0.50	0.30	1.50	174.2	174.0	30	+	—	—
October 10, 1914......	.004	.020	.001	0.80	0.70	0.88	208.0	204.0	45	+	—	—
VILLAGE SUPPLY												
October 13, 1914......	.002	.076	.001	0.20	3.30	1.25	36.4	32.0	20	—	—	—

The results of the analyses of the water from the institution spring indicate in general a good supply, except that the water is very hard and, although the bacterial content was low, organisms of the B. coli type were found present. This latter objection, however, is doubtless due to the unrestricted access of stock to the springs before the construction of the fence now protecting it. With proper protection of the spring, as indicated above, this pollution can doubtless be eliminated.

The analysis of the sample taken from the village supply indicates a low organic and bacterial content and the absence of organisms of the B. coli type in quantities as large as 10 c. c. It is thus evident that this supply was not polluted at the time the sample was taken.

Plumbing

The plumbing at the institution has been installed within the last three or four years under the direction of the State Architect and appears to be satisfactory in type and also in good condition. Lavatories and toilets appear to be conveniently located and sufficient for the needs of the institution. Two shower baths are provided in the gymnasium and two others in another separate building.

Sewerage and sewage disposal

The domestic sewage of the institution is collected in 6-inch tile sewers and carried to a disposal plant. Plans for the sewage disposal plant of the institution were approved in 1911. (Volume 32, page 536, annual report, State Department of Health.) The disposal plant, consisting of a septic tank and subsurface irrigation system, is located about 150 feet to the south of the main buildings of the school along the edge of a gully. The sewage is carried across the gully by means of a 5-inch cast iron inverted siphon provided with a screen composed of bars spaced two inches apart, through which the sewage is passed before entering the siphon in order to prevent clogging. The septic tank has a sufficient capacity to give seven hours' detention of sewage when serving the ultimate population of 200 persons contributing sewage at the rate of 25 gallons per capita. From the septic tank the sewage flows into a dosing tank provided with a 5-inch automatic siphon, by means of which it is discharged into a subsurface irrigation system consisting of four lines of bell and spigot vitrified pipe about 300 feet long and spaced 17 feet apart. It appears that the disposal plant was constructed in accordance with the plans as approved and that it has operated satisfactorily.

In addition to this disposal plant a similar one has since been constructed in the vicinity of the dairy building. It consists of a sedimentation tank 8 feet in diameter and 10 feet deep, with 4–100 feet lines of subsurface irrigation. This disposal plant receives the drainage from the dairy barn and demonstration building and also the sewage from three closets, two urinals and six lavatories. This plant is constructed practically along the same lines as the one previously described, but the plans were not submitted to the Department of Health for approval as required by law.

Garbage disposal

A small amount of garbage at the domestic science building is collected daily in covered galvanized iron cans and fed to pigs. Aside from this there is no garbage at the institution except ordinary refuse such as may accumulate.

Heating and ventilation

Heating.— The direct system of steam heat is used for heating the various buildings. Separate plants are provided, and so far as could be determined by the inspection the facilities are adequate and satisfactory for properly heating the various buildings and class rooms.

Ventilation.— No special provision is made for ventilation, the windows being depended upon in all cases. It appears that some of the class rooms and

laboratories are somewhat crowded especially in view of the fact that they depend entirely upon the windows for ventilation. The soil laboratory located in Madison hall is a room 17x22 feet and must accommodate 22 students at one time, and the chemical laboratory, a room 17x34 feet, accommodates 24 students, thus allowing insufficient room for laboratory purposes. One class room 17x34 feet has a seating capacity of 42 and another in Bicknell hall 24x24 feet seats 50 people. More satisfactory ventilation should be provided in these rooms.

Milk supply

The milk produced at the institution is used in the manufacture of butter and cheese and other similar products for the instruction of the students. The dairy facilities, equipment and method of handling the milk and other dairy products are modern, and conditions were found satisfactory at the time of the inspection.

As a result of this investigation it may be considered that the general condition of the institution was quite satisfactory except regarding the water supply, which, however, is being improved, and regarding ventilation. I would therefore beg to submit the following recommendations:

Recommendations

1. That, in view of the possibilities of contamination of the institution spring by surface drainage from the land above the spring, the necessary drainage ditches be provided to divert this surface water from the springs.

2. That, regarding ventilation, better ventilating facilities be provided in those class rooms and laboratories where the present system is inadequate.

Respectfully submitted,

THEODORE HORTON,
Chief Engineer

ALBANY, N. Y., *April* 2, 1915

INVESTIGATION AND SUPERVISION OF DISPOSAL PLANTS

The work started during 1914 on the investigation of sewage disposal and trade wastes plants has been continued during the first part of the year 1915. This work was done by one of the assistant engineers of the Engineering Division who visited the plants, obtained a description of them and their operation and, with a field laboratory, made chemical analysis of the raw sewage, the different effluents and the water of the streams into which the effluents were discharged. In those cases where the removal of bacteria was important such as the discharge of the effluent into water used as a source of public water supply, total counts of bacteria in the different effluents and water of the stream were also made. In the reports of investigations made in 1915 plans showing the general layout of the plants, together with the profile of the path of the sewage through the plant, were made to accompany the reports. In this way a very complete and thorough description and a determination of the operating efficiency were obtained of each of the 15 municipal and 9 institutional and trade waste plants investigated. Owing to the lack of sufficient engineering force and to the need of obtaining more complete information on all the public water supplies of the State the work of inspecting sewage disposal plants was temporarily suspended during the year, although it is hoped that this work may at some future time be resumed.

As a result of the investigations made during the past two years the following conclusions may be stated with reference to the general condition and operation of the plants investigated.

1. That in general the disposal plants were being operated in a fair condition, although some were greatly overtaxed or were being operated in a very unsatisfactory manner, while a few were being operated and maintained in a good condition.

2. That in the construction of some of the plants certain important parts were omitted which resulted in the plant not being operated as intended or in producing a decidedly inferior effluent and, therefore, it would seem advisable for this Department to

make an inspection of all plants shortly before they are placed in operation to determine if they are built substantially as called for by the approved plans.

3. That as a result of the inspections and the recommendations contained therein, many of the municipalities or officials in charge seem ready and willing to improve operating conditions and in some instances have submitted plans for improvements of the disposal works.

4. That if the disposal plants in the State are to be operated and maintained in an efficient manner it would seem necessary as a prerequisite, that this Department make regular inspections and occasional tests of operation of all disposal plants and that the frequency of these inspections and tests be dependent upon the degree of purification required and upon the size of the plant.

Following these investigations it was learned through subsequent inspections or by correspondence that over 80 per cent. of the plants needing improving have been improved in operation or that amended plans for improvements or additions to the plants have been submitted to this Department for approval. The following list gives the location where improvements have been noted and also indicates the character of the improvements:

Brockport	New disposal plant under construction.
Central Square (Creamery)	Improved operating condition.
Hobart	Improved operating condition.
Middleport	Slight changes and improved operating condition.
Newark	Improved operating condition.
Stamford	Improved operating condition.
Westfield	Additions and improved operating condition.
White Plains (Gedney Farm)	Additions and improved operating condition.
Mt. Vernon	Appropriation provided for improvement during 1916.
Franklinville	Partial improvement in operation.
Pelham	Partially improved operating condition.
Seneca Falls	Improved operating condition.
Skaneateles	Improved operating condition.
Fulton	Improved operating condition.
Auburn	Partially improved operating condition.
E. Syracuse	Plans submitted and approved for new disposal plant.
Penn Yan	Improved operating condition.
Ithaca	Partially improved operating condition.
Dansville	Improved operating condition and partial removal of storm water.
Avon	Improved operating condition.
East Aurora	Improved operating condition.
Eastview (Loeb Convalescent Home)	Improved operating condition.

Cornwall-on-Hudson (Stone School)	Improved operating condition.
Pocantico Hills (St. Joseph's College)	Improved operating condition.
Pleasantville (Hebrew Sheltering-Guardian Society)...	Improved operating condition.
Westfield (Disposal of grape juice wastes)	Old plants abandoned and wastes now screened and conveyed to Lake Erie.

The reports of the investigations of sewage disposal plants made during 1915 are presented herewith:

AUBURN

HERMANN M. BIGGS, M.D., *State Commissioner of Health:*

I beg to submit the following report on an investigation of the sewage disposal plant serving portions of Wards 1, 6 and 10 of the city of Auburn, Cayuga county, made on December 4, 1914. This investigation was made by Mr. Morton F. Sanborn, assistant engineer, in connection with the general investigation now being carried on of the sewage disposal plants in the State.

Location and general description

Location.— In the central part of Cayuga county, on Owasco outlet, about three miles north of Owasco lake, on the New York Central and Hudson River railroad, Auburn branch, and the Lehigh Valley railroad, Auburn division.

Population.— The population at the time of the inspection was estimated at 36,500.

Public water supply.— Municipal, from Owasco lake.

Sewer system.—About 78 miles of sanitary and combined sewers ranging in size from 8 inches to 36x48 inches.

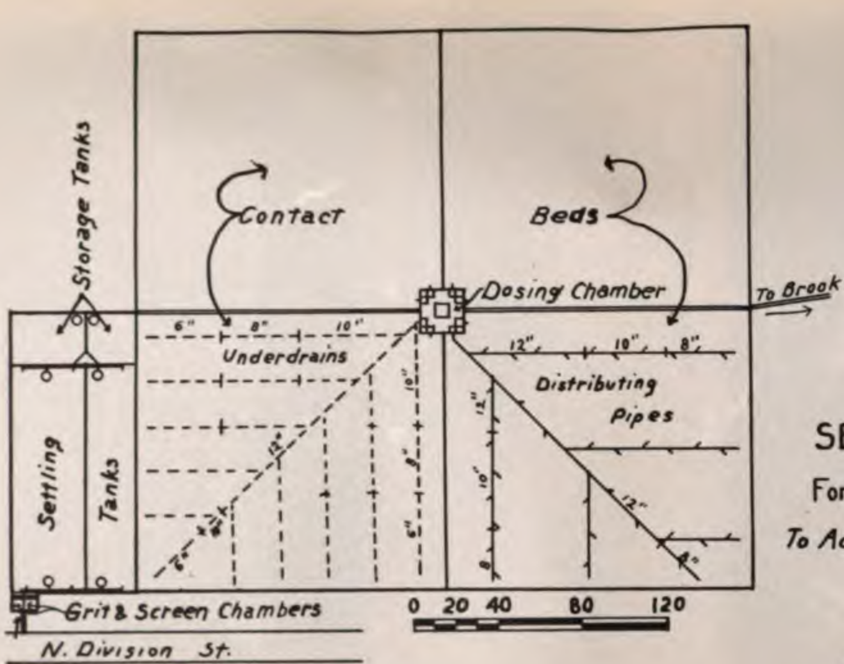
Sewage disposal plant.— The sewage disposal plant for the 1st, 6th, 8th and 10th wards consists of a grit and screen chamber, two settling tanks, an automatic dosing and draining chamber and four contact beds.

The city of Auburn is principally a manufacturing city and is located on the Owasco outlet about three miles from Owasco lake. This outlet or river as it passes through the city of Auburn has a total fall of about 150 feet and there are on the river many dams, at which places the water power is utilized in the manufacturing industries. The population has increased steadily in recent years, as shown by the census reports, there being 31,422 in 1905, 34,668 in 1910, and at the time of inspection the population was estimated at about 36,500.

The public water supply of Auburn is obtained from Owasco lake. This supply is a municipal one and the water is pumped direct to the distributing system and reservoir of the city. The water is treated with liquid chlorine at the pumping station. Practically all of the inhabitants are served by this water supply, as well as the inmates in the State prison and some of the adjacent districts. The average daily consumption is about 6,291,000 gallons, which corresponds to a per capita consumption of about 165 gallons daily. This rate is quite high and is undoubtedly due to the large amount of water used in the different industries located in and about Auburn.

The sewer system of Auburn is built largely on the combined plan, although the districts served by this disposal plant and the plant serving portions of Wards 4, 5, 6 and 7 are on the separate system. There are in the city about 78 miles of sewers, varying in size from an 8-inch pipe to 36x48-inch stone sewer. Practically all of the population are served by the sewer system. The sewers leading to this disposal plant vary in size from 8 inches to 24 inches.

This disposal plant receives sewage from parts of Wards 1, 6 and 10, and it was estimated that about 2,985 people were contributing to the plant. This

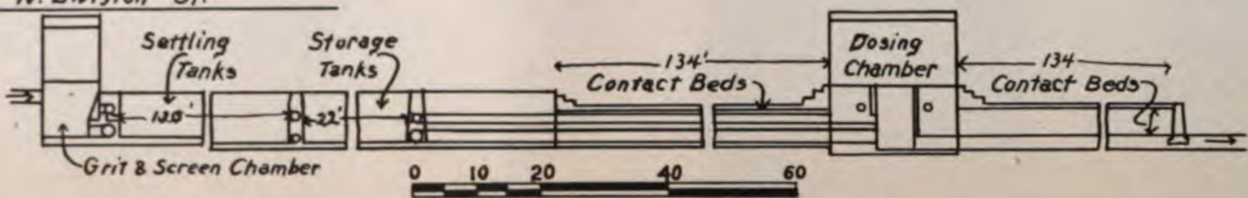


AUBURN

SEWAGE DISPOSAL WORKS.

For Portions of Wards 4,5,6 & 7.

To Accompany Report of May 6, 1915.



period would be 21¾ hours. Leading from the 15-inch distributing pipe are two 10-inch pipes to the small tank and three to the large tank. These influent pipes enter the tank through the bottom of the end wall. Located about mid-depth in the opposite end of the tank are a similar number of 12-inch pipes which lead to the 15-inch collector. This collector conveys the sewage to the effluent weir compartment located between the tanks. The weir in this compartment is eight feet long and the sewage flowing over the weir is discharged into either or both of the storage chambers. Six-inch pipes with gate valves are provided at the bottom of the tanks to convey the sludge to the 24-inch by-pass. At the time of the inspection the large tank was being used and both tanks were about half full of sludge. No sludge has ever been removed from the tanks.

Storage tanks.— There are two storage tanks corresponding in depth and width to the two settling tanks. These tanks are about 28 feet long and the depth of sewage in them is fixed by the elevation of the outlet pipe, which gives a depth of about three feet. The large tank therefore has a capacity of 22,000 gallons and the small tank a capacity of about 14,500 gallons. Provision is made for drawing off the sludge accumulating in the tanks and discharging it into the by-pass. These tanks do not appear to be of much benefit to the plan except to give a small additional sedimentation period. With the amount of sewage flowing of 286,300 gallons per day a detention period of nearly three hours would be obtained with the large tank in use, while with the small tank in use the detention period would be about 1¼ hours. At the time of the inspection the large tank was in use.

Dosing chamber.— The dosing apparatus is contained in a 24x24-foot one-story house located in the central portion of the contact bed area. In this chamber are located four automatic feed siphons and four timed siphons. The feed siphons are supposed to discharge the sewage automatically on to each of the four beds in rotation and the timed siphons are supposed to discharge the effluent from the beds after the sewage has remained standing in them a predetermined time. At the time of the inspection the siphons were not operating properly and the sewage was flowing continuously through one of the beds without any period of contact or any alternating of the use of the beds. As far as the inspector was able to ascertain from those in charge of the plant the siphons have never operated properly, and the superintendent visits the plant about once a week to divert the flow of sewage from the bed in use to one of the other beds.

Contact beds.— The four contact beds are each 125 feet square, although a small portion of this area is occupied by the dosing chamber. The net area of each bed is about 15,480 square feet, which is equivalent to about 1.4 acres for the four contact beds. The side walls and the partitions between the beds are constructed of concrete and the bottom of the filters consists of the natural soil, which has been compacted by rolling. The filtering material consists of four feet of broken stone varying in size from one-half inch to two inches. The distributing pipes are laid on the surface of the beds and consist of tile pipe varying in size from 15 inches to 6 inches. The underdrains consist of several lines of tile pipe from 6 to 12 inches in size. With the amount of sewage flowing at the time of the inspection if distributed over the entire area the rate of filtration would be about 200,000 gallons per acre per day, or 50,000 gallons per acre per foot in depth per day. At the time of the inspection, however, only one of the beds was being used and the sewage was passing through that bed continuously.

Sludge disposal.— No provision is made for removing sludge from the chambers or tanks except by discharging it through the by-pass and effluent pipe into the brook. No sludge has ever been removed from the settling tanks.

Operation and cost of plant.— The superintendent of public works has charge of the plant and usually visits the disposal works about once a week. The cost of the disposal plant, exclusive of real estate, was $43,100. The cost of maintenance is comparatively small, since no work has been done in maintaining the plant in an efficient condition.

Efficiency of plant as determined by chemical analyses

In order to determine the efficiency of the disposal plant to properly treat the sewage contributed to it and also as a test of the efficiency of the different units comprising the plant, analyses were made of the sewage, of the different effluents and of the water of the stream into which the effluent was discharged. The report of these analyses, which include the temperature of the samples, gives the results of the tests of settling, turbidity, oxygen consumed, dissolved oxygen, chlorine and putrescibility, and these results are shown in the following table:

ANALYSES MADE ON DEC. 4, 1914

	Temperature	Imhoff cone c. c. in 1 hour	Parts Per Million					Putrescibility days
			Turbidity	Oxygen consumed 10 min. boiling	Dissolved oxygen		Chlorine	
					Parts	Per cent of saturation		
Raw sewage	47	1.5	100	50	3.9	33	26	....
Tank effluent	47	0.4	55	24	0.0	0	20	....
Filter effluent	49	0.3	45	18	2.8	25		2 1/6
Stream above	42	....	Clear	7.4	10.2	81	7	Over 20
Stream below	43.5	....	Slightly turbid	9.2	8.0	65	10.5	13 5/6

While these results may not represent average conditions of operation of the plant over a long time, they do nevertheless show clearly the efficiency of the different units of the plant and of the plant as a whole, and indicate the condition of the stream into which the effluent is discharged. The results of the analyses, together with the efficiency of the different units, will be stated as follows:

The raw sewage as received on the day of inspection gave 1.5 cubic centimeters of readily settling matter in the Imhoff cone test. The turbidity was 100 parts and oxygen consumed 50 parts. These determinations, together with the 26 parts of chlorine, indicated a sewage of about one-third to one-half the strength of an average domestic sewage of the day flow. The 39 parts of dissolved oxygen plainly indicated the fresh character of the sewage.

The tank effluent gave 0.4 c. c. in the settling test, as compared with the 1.5 in the raw sewage. This indicated a removal of 73 per cent of the readily settling matter. The turbidity was reduced from 100 parts to 55 parts and the oxygen consumed from 50 to 24 parts. These two determinations indicated a removal of about 50 per cent and were due to the settling of suspended matter. The chlorine test of 20 parts in the tank effluent showed a somewhat smaller chlorine than was found in the raw sewage. The absence of dissolved oxygen in the tank effluent indicated that it was in a septic condition.

The contact bed effluent contained 0.3 c. c. of readily settling matter, as compared with the 0.4 c. c. found in the tank effluent. This showed a removal of only 25 per cent as the tank effluent passed through the contact beds. The turbidity was reduced from 55 parts to 45 parts, which is equivalent to a decrease of 18 per cent. The oxygen consumed of 18 parts as compared with 24 parts of the tank effluent showed a reduction of 25 per cent. These tests indicated that only a slight amount of purification was being obtained by the contact beds, as might be expected when the beds were being operated as coarse strainers rather than as contact beds. The 2.8 parts of dissolved oxygen were probably due to the aeration the sewage received as it was discharged on the bed and as it passed down through the bed. In the putresci

bility test this effluent had a stability of only 2 1-6 days and showed very plainly the unsatisfactory and unstable character of the sewage.

The stream above the discharge of the effluent was clear. It had 7.4 parts of oxygen consumed and seven parts of chlorine. These two tests indicated a slight amount of pollution of the brook before the water received the effluent from the disposal plant. The dissolved oxygen test gave 10.2 parts and represented a possible saturation of 81 per cent. The sample was stable, as shown by the putrescibility test.

Referring lastly to the water in the stream after receiving the effluent from the disposal plant, the analyses plainly indicated the presence of the effluent. This is shown by the suspended matter which could be observed in the water and by the increase of oxygen consumed from 7.4 parts to 9.2 parts. The reduction in dissolved oxygen from 10.2 parts to 8 parts was due to the condition of the effluent, which contained only a small amount of dissolved oxygen. The increase in chlorine from 7 parts to 10½ parts also indicated the presence of the effluent. In the putrescibility test the sample had a stability of 13 5-8 days, and while this would be considered good for a filter effluent, the combined brook water and effluent should have remained stable.

The effluent from the contact beds is discharged into an open ditch about 100 feet long, through which it flows before it is discharged into Hunter brook. The effluent while in this ditch did not receive any dilution, and therefore it was in the same unsatisfactory and unstable condition as discharged from the plant. This unsatisfactory condition was plainly evidenced by the bed of the ditch, which was covered with a dense growth of sewage fungi, and by the sewage odor, which was quite pronounced. Upon the discharge of the partially purified effluent into the brook a nuisance is created, as is shown by the odors, by the growth of sewage fungi in the bed of the river and by the putrescibility of the brook water after the discharge into it of the inadequately purified effluent.

Summary and conclusions

As a result, then, of the investigation of this plant and after careful consideration of the condition of operation, and the results of analyses of the effluent from the various parts of the plant and of the brook water, the following summary and conclusions are presented:

1. The excessive amount of rain and street wash which enters the sanitary sewers during a storm causes the plant to be overtaxed and at times the sewage has overflowed the settling tanks.
2. The amount of sludge in the grit chamber prevented an efficient sedimentation of suspended matter.
3. The excessive quantity of sludge in the settling tanks prevented efficient sedimentation of the settling matter, as is shown by the .4 c. c. of sludge remaining in the effluent.
4. The feed and timed siphons were not operating properly, and the result is that the sewage passing through the contact bed is only partially strained. This gives a decidedly unsatisfactory effluent, and if the contact beds were operated as such the effluent would undoubtedly be in a much better condition.
5. The lack of any sludge disposal arrangements is unsatisfactory, since the only method at present is that of discharging the sludge into the brook.

Recommendations

In view of the results of this investigation, I would recommend that the city authorities be requested to make the following changes in the sewer system and the disposal plant in order that the effluent when discharged may be at all times in a stable and satisfactory condition:

1. That the practice of discharging roof water and storm water into the sanitary sewers be discontinued, especially as this was prohibited by the permit issued for the discharge of effluent from this plant.

2. That both grit chambers be cleaned of sludge and that at no time should more than one-third of their capacity be occupied with scum or sludge.

3. That the sludge in the settling tanks be removed and that at no time should more than one-third of their capacity be occupied with scum or sludge.

4. That sludge beds of proper size and design be constructed and that no sludge or scum be discharged at any time into the brook.

5. That the automatic siphons be placed in an operating condition and, if this cannot be done, that they be removed and a type installed that will give an effective automatic operation.

6. That the contact beds be always operated as such with a proper period of contact.

Furthermore, since it is evident that the plant has never been placed in an effective operating condition nor properly maintained, I would also recommend that in case the city of Auburn does not place the plant in an efficient condition within a reasonable time that consideration be given to taking action under the provisions of sections 80 and 84 of the Public Health Law.

Respectfully submitted,
THEODORE HORTON,
Chief Engineer

ALBANY, N. Y., *May* 4, 1915

AUBURN

HERMANN M. BIGGS, M.D., *State Commissioner of Health:*

I beg to submit the following report on an investigation of the sewage disposal plant serving portions of Wards 4, 5, 6 and 7 of the city of Auburn, Cayuga county, made on December 3, 1914, and March 22, 1915. This investigation was made by Mr. Morton F. Sanborn, assistant engineer, in connection with the general investigation now being carried on of sewage disposal plants in the State:

Location and general description

Location.— In the central part of Cayuga county, on Owasco outlet, about three miles north of Owasco lake, on the New York Central and Hudson River railroad, Auburn branch, and the Lehigh Valley railroad, Auburn division.

Population.— The population at the time of inspection was estimated at 36,500.

Public water supply.— Municipal supply taken from Owasco lake.

Sewer system.— There are in the city of Auburn about 78 miles of sanitary and combined sewers ranging in size from 8 inches to 35x43 inches.

Sewage disposal plant.— The sewage disposal plant consists of a grit and screen chamber, two settling tanks, an automatic dosing and draining chamber and four contact beds.

Auburn is chiefly a manufacturing city and is situated on the Oswasco Outlet about three miles north of the lake. On this outlet are many dams where considerable water power is utilized. There is a total fall of about 150 feet in the outlet as it passes through the city. There has been a steady increase in the number of inhabitants in recent years, there being 31,422 in 1905; in 1910 there were 34,668 inhabitants, and on the date of inspection the population was estimated at about 36,500.

The public water supply is obtained from Owasco Lake and is a municipal supply. The water is pumped directly to the distributing system and reservoir of the city after being treated with liquid chlorine at the pumping station. Practically all of the inhabitants are served by this water supply and water is also furnished to the 1,600 people in the State Prison and to some of the adjacent districts. The average daily consumption is about 6,291,000

gallons. This gives a per capita consumption of about 165 gallons daily, although considerable of the water is used by the different industrial establishments located in and about Auburn.

The greater part of the sewer system of Auburn is built on a combined plan, although the districts served by this disposal plant and the plant serving portions of Wards 1, 6, and 10 are on the separate system. There are about 78 miles of sewers in the city, varying in size from an eight-inch pipe to a 36 by 48-inch stone sewer. Practically all of the population is served by the sewer system. The sewers leading to the disposal plant vary in size from eight inches to twenty inches. This disposal plant receives the sewage from parts of Wards 4, 5, 6 and 7, and it was estimated that about 4,487 people were contributing to the disposal plant. This would represent about 12.3 per cent. of the entire population. On the day of inspection, December 3, 1914, the flow as measured at the outlet pipe amounted to approximately 349,200 gallons per day, which is equivalent to about 78 gallons per capita per day. There are two breweries connected with this sewer system and the sewers also serve some of the factories of the International Harvester Company. Many of the houses in this sewer district are connected in such a manner that the roof water enters and during periods of heavy rain the amount of sewage reaching the disposal plant is more than it can properly handle.

The disposal plant was designed by George S. Pierson, civil engineer of Kalamazoo, Mich., and the plans were approved by this Department on May 15, 1905. The plant was constructed under the direction of the City Engineer and was completed and placed in operation in 1908.

The effluent from the disposal plant is discharged into a small ditch or brook. This brook rises on the property of the city which was purchased for the site of the disposal plant and the effluent receives a comparatively small amount of dilution before it reaches Owasco Outlet, which is about two miles distant. This brook does not receive any other sewage or wastes of any character, although the outlet from the lake receives the greater part of the sewage of the city of Auburn.

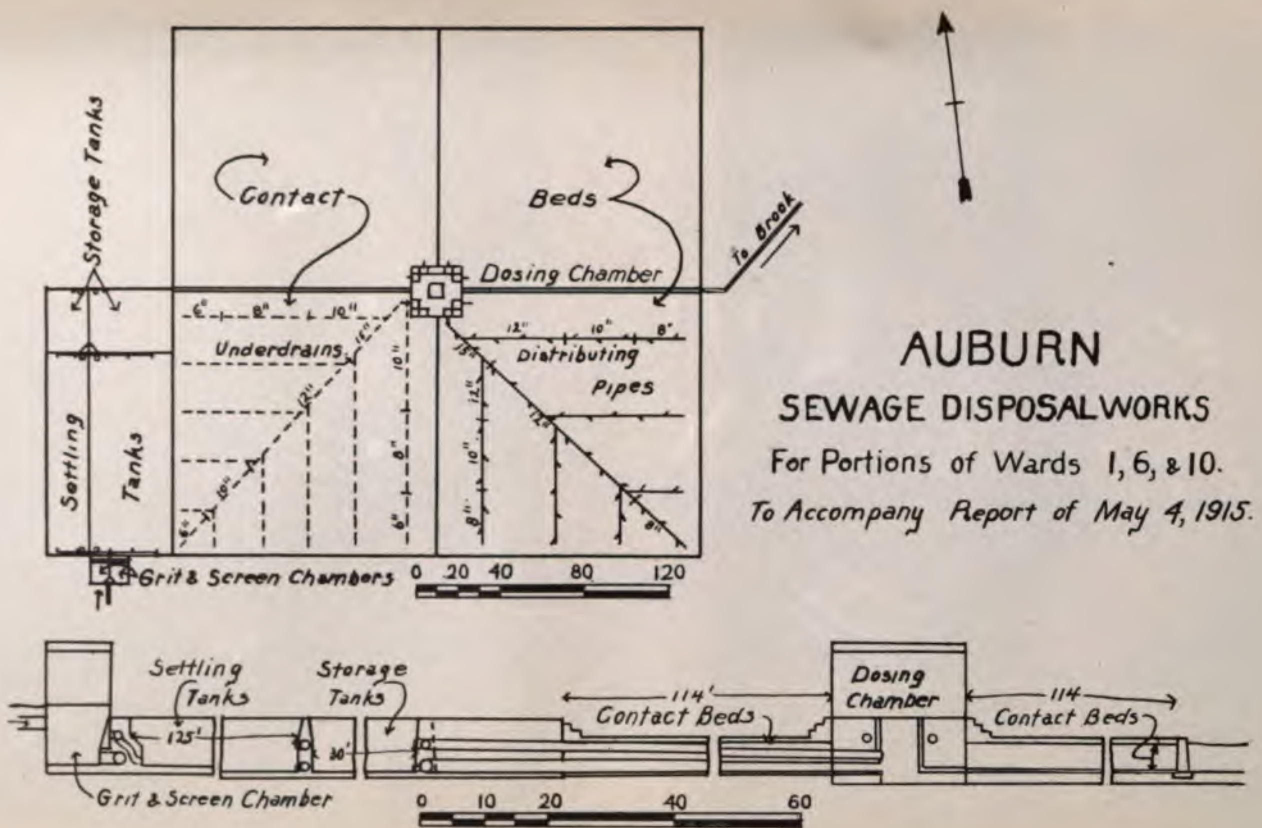
Description of sewage disposal works

The sewage disposal plant consists of a grit and screen chamber, two settling tanks, two storage tanks, a dosing and draining chamber, and four contact beds.

Site.— The disposal plant is located on the west side of North Division street, near the northern boundary of the city. It is situated in the low area at the head waters of the brook into which the effluent is discharged. There are two houses from 500 to 700 feet from the disposal plant.

Grit and screen chamber.— The grit and screen chamber is constructed of concrete and is 8 feet 6 inches by 12 feet 8 inches in plan. This chamber or tank is divided into two equal parts by a partition wall and they each have a total depth of 8½ feet. Four and one-half feet above the bottom of each compartment is a 12-inch pipe, controlled by a water gate, through which the effluent passes to a 12-inch distributing pipe. In front of each effluent pipe is a screen, five feet high and six feet wide, consisting of ¾-inch x 1¼-inch iron bars so spaced as to give vertical openings of 1¼ inches. Near the bottom of each chamber is a 20-inch pipe, controlled by a valve, which passes around the settling tank and discharges into the effluent well in the lower part of the dosing chamber. The elevation of the sewage in the grit chamber is fixed by the effluent weir of the settling tank, which gives a depth of about six feet. Each chamber, therefore, has a capacity of about 2,000 gallons and a theoretical detention period of eight minutes, with the amount of sewage flowing as found during the inspection.

At the time of the first inspection, only one chamber was being used and it was practically filled with sludge and scum, which prevented any sedimentation. At the time of the second inspection, although the scum had been removed, the rapid flow of sewage and the currents caused by the flowing sewage practically prevented any sedimentation of suspended matter except of the heaviest character.


AUBURN
SEWAGE DISPOSALWORKS
For Portions of Wards 1, 6, & 10.
To Accompany Report of May 4, 1915.
Storage Tanks
Contact
Beds
Dosing Chamber
To Brook
Underdrains
Distributing
Pipes
Settling
Tanks
Grit & Screen Chambers
0 20 40 80 120
Settling
Tanks
125'
Storage
Tanks
30'
114'
Contact Beds
Dosing
Chamber
114
Contact Beds
Grit & Screen Chamber
0 10 20 40 60

acre per day, or 51,350 gallons per acre per foot in depth per day. At the time of the inspection, however, only one of the beds was in use and the sewage was passing through the bed continuously; therefore the bed was simply performing the functions of a coarse strainer.

Sludge disposal.— No provisions are made for removing sludge from the chambers or tanks except by discharging it with the effluent into the brook. Scum has several times been removed by this method, but the sludge in the settling tanks has never been removed.

Operation and cost of plant.— The superintendent of public works has charge of the plant and usually visits the disposal works about once a week. The cost of the plant, exclusive of real estate, was $51,700. The cost of maintenance is comparatively little, since no work has been done in putting the plant in proper shape.

Efficiency of plant as determined by chemical analyses

In order to determine the efficiency of the disposal plant to properly treat the sewage contributed to it and also as a test of the efficiency of the different units comprising the plant, analyses were made of the sewage and of the different effluents. The report of these analyses, which include the temperature of the samples, gives the result of tests of settling, turbidity, oxygen consumed, dissolved oxygen, nitrates, chlorine and putrescibility, and the results are shown in the following table:

ANALYSES MADE ON DECEMBER 3, 1914, AND MARCH 22, 1915

	Date	Time	Temperature	Imhoff cone c. c. in 1 hour	PARTS PER MILLION						Putrescibility, days
					Turbidity	Oxygen consumed 10 min. boiling	DISSOLVED OXYGEN		Nitrates	Chlorine	
							Parts	% of saturation			
Raw sewage	3/22/15	8:30 A. M.	43	12.0	600	360	1.9	15	......	240	1
	3/22/15	12 M.	....	3.5	200	96	......	......	......	25	.....
Tank effluent	12/4/14	10 A. M.	50	0.1	180	34	0.4	3	....	28	5/6
	3/22/15	8:45 A. M.	40	0.75	200	51	2.8	21	....	35	1 1/2
Contact bed effluent	12/4/14	10 A. M.	48	0.1	100	37	1.2	10	0.16	28	5/6
	3/22/15	10 A. M.	41	....	65	38	1.9	15	0.4	40	;
Stream one-half mile below	3/22/15	2 P. M.	42	....	70	26	2.7	22	....	35	2

While these results may not represent average conditions of operation of the plant over a long time, they do nevertheless show clearly the efficiency of the plant at the time of the inspection, and the results of the analyses, together with the efficiency of the different units, will be stated as follows:

Inspection of December 3, 1914.— At the time of this inspection a sample of the raw sewage could not be obtained on account of the quantity of scum on the surface of the sewage in the grit chamber and because the grade of the main sewer is such that the sewage rises in the manholes, and it contained considerable grease and other floating substances.

The tank effluent gave 0.1 cubic centimeter of sludge in one hour in the settling test and had a turbidity of 180 parts. The chlorine test of 28 parts and the 38 parts of oxygen consumed indicated a strength of the effluent of about one-third of the amount usually found in the average domestic sewage of the day flow. The 0.4 parts of dissolved oxygen indicated that the effluent was practically devoid of oxygen. In the putrescibility test the effluent gave a stability of five-sixths of a day and is about what could be expected from a tank effluent at this time of the year.

The contact bed effluent gave the same amount of sludge as that obtained from the tank effluent, namely, 0.1 c. c. in one hour. The oxygen consumed test also gave practically the same result as that found in the tank effluent, although the turbidity was reduced from 180 to 100 parts. The increase in dissolved oxygen to 1.2 parts was no doubt due to the aeration the tank effluent received as it was discharged on the surface of the contact bed. The 0.16 parts of nitrites is exceedingly low and shows practically no nitrification. The low stability as well as the other tests plainly showed the unsatisfactory character of the effluent.

The bed of the brook was covered with a sewage fungus growth and the effluent was turbid and particles of suspended matter could be plainly seen in the effluent. There was also a strong sewage odor in the vicinity of the brook.

Inspection of March 22, 1915.—At the time of this inspection the scum had been removed from the grit chamber and a sample of the raw sewage was taken at this place.

The sample of the raw sewage taken at 8:30 a. m. apparently contained considerable trade wastes, as the analysis shows, and the sample seemed to contain an oily emulsion. The character of this sewage continued the same for about two hours, after which time the sewage became nearly normal, and a sample was obtained of this sewage at noon. The efficiency of the plant will therefore be considered as referring to the noon sewage rather than to the sample which contained the trade wastes.

The strength of the raw sewage collected at noon was about the same as that of the average day flow of domestic sewage, as shown by the settling, turbidity and oxygen consumed test, although the chlorine test indicated a much weaker sewage.

The sample collected at 8:30 a. m. showed stability for one day, and this was what would be expected of a strong sewage containing 1.9 parts of dissolved oxygen during the cold weather prevailing at this time of the year.

The tank effluent taken at 8:45 a. m. gave 0.75 cubic centimeter of sludge in the settling test, as against the 3.5 parts found in the raw sewage, and indicated a removal of 79 per cent. of the readily settling matter. The turbidity test gave 200 parts, which was the same as that of the raw sewage. In the oxygen consumed test 51 parts were obtained, as compared with the 96 parts of the raw sewage. This showed a reduction of organic matter of 45 per cent. The dissolved oxygen test gave 2.8 parts, and part of this was due to a small amount of aeration the effluent received before it was collected for the test. The chlorine was slightly higher than in the sample of raw sewage taken at noontime. In the putrescibility test the sample had a stability of 1½ days.

The analysis of the contact bed effluent plainly shows the straining action of the beds in the reduction of turbidity and oxygen consumed. The reduction in turbidity from 200 parts to 65 parts showed a removal of 68 per cent. and the reduction of organic matter was about 25 per cent., as shown by the decrease in the oxygen consumed test from 51 to 38 parts. The reduction from 2.8 parts of dissolved oxygen to 1.9 parts, the low nitrates of 0.4 parts and the putrescibility of the effluent all indicated the absence of any nitrification taking place in the contact beds.

Samples taken of the brook water one-half mile below the discharge of the effluent plainly showed little or no dilution of the effluent by fresh water entering the brook. This is shown by the chlorine test of 35 parts, which is practically the same as that of the tank effluent and the contact bed effluent. The turbidity test of 70 parts showed that, although the suspended matter might be somewhat changed in character, it gave about the same turbidity as the contact bed effluent. The oxygen consumed test gave 26 parts, as against 38 parts in the contact bed effluent. This represented a reduction of 32 per cent. of organic matter, which was probably due to a partial purification brought about by the settling of some of the suspended water and by the fungus growth and other microscopical organisms on the bed of the brook or that were carried in the effluent. The 2.8 parts of dissolved oxygen was undoubtedly due to aeration the sewage received in flowing through the ditch. The sample tested for putrescibility was stable for two days and plainly indicated the unsatisfactory condition of the brook water at this place.

The bed of the ditch or brook into which the effluent was discharged was covered with dense fungus growth which contained many of the microscopical organisms common to unpurified sewage. This growth continued along the bed of the brook, and at a point about one-half mile from the discharge of the effluent the bottom was still covered with the growth, although it appeared to be about two-thirds as dense as at the point of discharge of the effluent. The effluent in the brook was turbid, particles of suspended matter could be plainly seen in the water and there was a strong sewage odor in the vicinity of the brook.

Summary and conclusions

As a result, then, of the investigation of this plant, and after careful consideration of the condition of operation and the results of analyses of the samples from various parts of the plant, the following summary and conclusions are presented:

1. The excessive amount of roof water entering the sanitary sewers and flowing to the disposal works not only interferes with the proper biological action, but at times partially flushes out the different units, and the suspended matter is discharged with the effluent into the brook.
2. The excessive amount of oil or other matter which floats on the surfaces of the tanks and at times is flushed out into the brook should be prevented by proper treatment of manufacturing wastes before their discharge into the sewer system.
3. At the time of the first inspection the excessive quantity of scum and sludge in the grit chamber prevented efficient settling of the heavy suspended matter, and although at the time of the second inspection the scum had been removed, the velocity through the tank was sufficient to prevent effective sedimentation of the heavier suspended matter.
4. The excessive amount of sludge in the settling tank prevented proper sedimentation of the settling solids contained in the sewage.
5. The inoperative dosing arrangement results in an effluent that is only partially strained, is not properly oxidized or nitrified and, in fact, is a decidedly unsatisfactory effluent, as is evidenced by the analyses and by the condition of the brook into which the effluent is discharged.
6. The present method of sludge and scum disposal by discharging it with the effluent into the brook is decidedly objectionable and practically cancels any benefit that is obtained by the use of the plant.

Recommendations

In view of the results of this investigation, I would recommend that the city authorities be requested to make the following changes in the sewer system and the disposal plant in order that the effluent may at all times be discharged in a stable and satisfactory condition.

1. That the practice of discharging roof water into the sanitary sewers be discontinued and that all such connections be changed as soon as possible.
2. That preliminary settling or other means be required to be provided to treat the trade wastes from the factories that discharge a large amount of oil or other objectionable matter into the sewers.
3. That both grit chambers be used at all times and that at no time should more than one-third of their capacity be occupied with sludge or scum.
4. That the sludge in the settling tanks be removed and at no time should more than one-third of their capacity be occupied with sludge or scum.
5. That sludge beds of proper size and design be constructed and that at no time should any scum or sludge be discharged into the brook.
6. That the automatic siphons be placed in an operating condition, and if this cannot be done, then they should be removed and a type installed that will give a proper automatic operation.
7. That the contact beds be always operated as such with a proper period of contact.

Furthermore, I would also recommend, since the plant has apparently never been placed in an effective operating condition nor properly maintained, that in case the city of Auburn does not place the plant in an efficient condition within a reasonable time that consideration be given to taking action under the provision of sections 80 and 84 of the Public Health Law.

Respectfully submitted,

THEODORE HORTON,
Chief Engineer

ALBANY, N. Y., *May* 6, 1915

AVON

HERMANN M. BIGGS, M.D., *State Commissioner of Health:*

I beg to submit the following report on an investigation of the sewage disposal plant of the village of Avon, Livingston county, made on May 4, 1915. This investigation was made by Mr. Morton F. Sanborn, assistant engineer, in connection with the general investigation now being carried on of sewage disposal plants in the State:

Location and general description

Location.— The village of Avon is located in the northern part of Livingston county and is about 20 miles southwest of Rochester, east of the Genesee river, and on the Rochester division of the Erie railroad.

Population.—At the time of inspection the population was estimated at 2,300.

Public water supply.— Municipal supply from Conesus lake.

Sewer system.— Seven miles of sanitary sewers and 1½ miles of storm water sewers.

Sewage disposal works.— Imhoff tank and sludge bed.

The village of Avon is largely a residential district and there are also a few manufactories located in the village. It is the junction point of two divisions of the Erie railroad. There has been a steady increase in the population in recent years, since there were 1,782 people in 1905 and in 1910 the number had increased to 2,053 and at the time of the inspection the population was estimated at 2,300.

The public water supply of the village is obtained from Conesus lake and is a municipal supply. This is a gravity supply and the water is used without filtration. About 1,725 of the inhabitants, or 75 per cent. of the population, are served by this water supply. The daily water consumption, according to information obtained from the village clerk, amounted to about 200,000 gallons per day, and this corresponds to a per capita consumption of about 116 gallons.

The sewer system of the village consists of about seven miles of sanitary sewers from 6 to 12 inches in size and about 1½ miles of 12-inch storm water sewers. About 60 per cent. of the inhabitants, or 1,380, are served by the sewer system and disposal works. The amount of sewage flowing on the day of inspection amounted to approximately 161,600 gallons per day. This figure was obtained by measuring the height over the effluent weir of the Imhoff tank. This amount of sewage flow corresponds to a per capita flow of those served by the sewers of 117 gallons per day. The sewage is practically a domestic sewage and probably contains only a small amount of ground water.

The sewage disposal works were constructed to comply with the requirements of the State Department of Health and the plans were designed by C. C. Hopkins, civil engineer of Rochester, and were approved by this Department on March 4 and May 22, 1912. The plant was constructed by S. Bonn under the direction of C. C. Hopkins and was completed and placed in service during the fall of 1912.

The effluent from the disposal plant is discharged into the Genesee river, which is tributary to Lake Ontario. This river has a watershed of 1,408 square miles above the discharge of the effluent, and at the time of the inspection the flow in the river amounted to approximately 880 cubic feet per second, or .62 cubic feet per second per square mile. This flow corresponds to a dilution factor of about 510 cubic feet per second per 1,000 population contributing sewage. The probable minimum flow of the river would be approximately 140 cubic feet per second, or .10 cubic feet per second per square mile. This minimum flow is estimated from the records of the flow of the river obtained at Rochester.

The banks of the river at Avon are about 20 feet high and quite steep and consist principally of clay. During periods of freshets the river has at times overflowed the bank, and about two years previous to the inspection the ground at the location of the disposal plant was entirely submerged. The waters of this river are not used for any public water supply and receive varying amounts of sewage from some of the municipalities through which the river flows.

Description of sewage disposal works

The disposal plant consists of a circular horizontal flow Imhoff tank and a sludge bed.

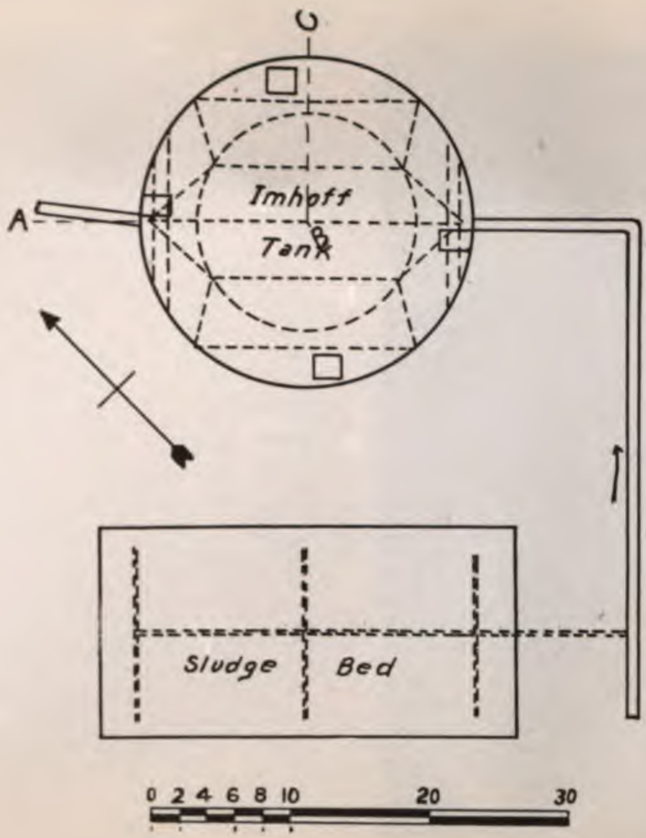
Site.— The plant is located in the northwestern portion of the village on the east bank of the Genesee river. It is about 200 feet from the road and about 300 feet from the nearest dwelling. The plant is situated about 300 feet from the river.

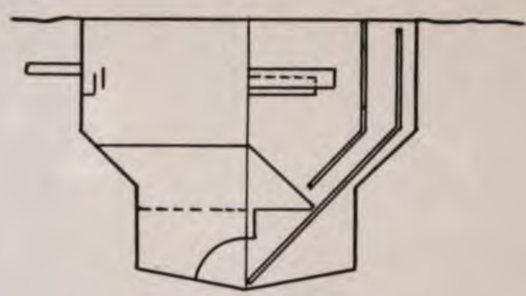
Imhoff tank.— This tank is a circular horizontal flow tank, and the tank is constructed of plain concrete with the exception of the partitions separating the sludge compartments from the settling chamber, which are of reinforced concrete. The main tank is 23 feet in diameter and the sludge compartment is 14 feet 10 inches in diameter. The settling compartment has an average depth of about 5½ feet and the total depth of the tank below the flow line is 15½ feet. The sewage enters the tank through a 12-inch pipe into a trough one foot wide at the center, one side of which is formed by the curved portion of the tank and the other by a weir which is about 10 feet long. A trough of similar size and shape is located at the opposite side of the tank and the effluent from the tank passes over the weir and out through the effluent pipe. Scum baffles 18 inches deep are placed 9 inches in front of the weirs and extend from about 6 inches above the surface of the sewage down to a point one foot below the surface.

The settling compartment has a width of 16 feet, and the portions of the tank outside of this width are used as gas vents for the sludge compartment. The tank is covered with a reinforced concrete floor supported by 12-inch "I" beams. There are four trap doors about two feet square located in the floor, one being over each of the two gas vents, one over the influent weir and the other over the effluent weir.

The capacity of the settling compartment is about 13,800 gallons and would give a theoretical detention period of about two hours with the amount of sewage flowing as found during the inspection. The capacity of the sludge compartment is about 870 cubic feet, which corresponds to about .63 cubic feet per capita served at present and .38 cubic feet per capita of the total population of the village. This sludge compartment will hold approximately about six months' accumulation of sludge.

The approved plans called for a house over the tank, for a central trap door and for a submerged centrifugal pump, and these were all omitted in the construction of the plant. The omission of the central trap door prevents the maintenance of the settling compartment in an efficient condition. In place of the submerged centrifugal pump a diaphragm hand pump is used to pump the sludge to the sludge bed. This method of pumping is not as efficient as the use of a submerged pump, since the suction pump tends to remove the gas entrained in the sludge and thus to require not only that the





Section A B C.

AVON

SEWAGE DISPOSAL PLANT

To Accompany Report of June 14, 1915

to the fresh character of the sewage. The dissolved oxygen test gave .6 of a part and indicated that the sewage was in a fresh condition. The chlorine test gave 125 parts, which is higher than the average domestic sewage. This result is probably due partially to the chlorine found in the public water supply and to chlorine which is probably contained in the normal ground water of the village. The putrescibility test gave a stability of one day, and is about what might be expected from a sewage of this character.

The Imhoff tank effluent gave 3.5 c. c. of readily settling matter in the Imhoff cone test. This result, as compared with the 4 c. c parts in the raw sewage, indicated a removal of only 12 per cent., and this low removal of suspended matter is due to the inefficient operation of the tank. In the turbidity test three different determinations were made and they all gave 200 parts. This result, as compared with the 157 parts of the raw sewage, showed an increase in the turbidity, which is undoubtedly due to the breaking up of some of the larger masses of suspended matter in the raw sewage. The oxygen consumed test gave 56 parts in the raw sewage and showed a removal of organic matter of about 14 per cent. The dissolved oxygen test gave practically the same result as that of the raw sewage. The chlorine test gave 125 parts, which was the same as that in the raw sewage. In the putrescibility test a stability of two days was obtained.

The water of the river above the discharge of the effluent had a turbidity of 25 parts. This turbidity is due to the character of the soil through which the river flows. In the oxygen consumed test three parts were obtained, which shows only a small amount of pollution. In the dissolved oxygen test 4.9 parts were obtained, which corresponds to a 47 per cent. saturation. The chlorine test of 45 parts ordinarily indicated pollution, but in this case it is probably due to the chlorine found in the normal waters in this part of the State. The sample was found stable in the putrescibility test.

Due to the large amount of water flowing in the river at the time of the inspection, no tests were made of the water below the discharge of the effluent, since the presence of the effluent could hardly have been detected.

The effluent from the plant is discharged close to the east bank of the river, and for a distance of 500 or 600 feet below the discharge of the effluent the bed of the river appeared black as compared with the rest of the river. This discoloration was due to the depositing of suspended matter contained in the sewage which should have remained in the Imhoff tank. The easterly portion of the river below the 600 or 700 feet below the discharge of the effluent did not appear to show this discoloration, due to better mixing of the sewage with the river water.

Summary and conclusions

As a result, then, of the investigation of this plant, and after a careful consideration of the condition of operation and of the results of analyses of the effluent from the plant, the following summary and conclusions are presented:

That the excessive quantity of sludge and scum in the settling compartment prevents the sedimentation of the readily settling matter contained in the raw sewage, and this accumulation of sludge is probably made greater by the infrequent periods of removal of sludge from the sludge compartment.

Recommendations

In view of the results of this investigation, I would recommend that the village authorities of Avon be requested to observe the following methods in the operation of the settling tank in order that the plant may at all times be operated in an efficient condition:

1. That the formation of scum and sludge in the settling tank be prevented, in the first case by the removal of any scum as soon as formed,

and in the second case by the use of squegees to force any sludge collecting on the sloping bottoms down through the slots into the sludge compartment.

2. That part of the sludge in the sludge compartment be removed from the same at least four times a year.

3. That scum in the vent chambers of the sludge compartment be removed at frequent intervals.

Respectfully submitted,

THEODORE HORTON,
Chief Engineer

ALBANY, N. Y., *June* 14, 1915

BEACON

HERMANN M. BIGGS, M.D., *State Commissioner of Health:*

I beg to submit the following report on an investigation of the sewage disposal plant serving part of the city of Beacon, Dutchess county, made on April 7, 1915. This investigation was made by Mr. Morton F. Sanborn, assistant engineer, in connection with the general investigation of sewage disposal plants in the State now being carried on. A previous investigation was made of this disposal plant during its construction in 1907, the report of which is published on page 794 of the 28th Annual Report of the State Department of Health. The plant was then being constructed to serve the village of Matteawan:

Location and general description

Location.— On the east side of the Hudson river, about 43 miles north of New York city and nearly opposite Newburgh, on the New York Central and Hudson River railroad and the New York and North Eastern Railroad.

Population.—At the time of the inspection the population was estimated at 12,000.

Public water supply.— Municipal supply from streams and reservoir.

Sewer system.—About 20 miles of sanitary sewers.

Sewage disposal works.— Grit chamber, two settling tanks and six contact beds.

The city of Beacon is principally a manufacturing and residential city and is also the home of the Matteawan State hospital, in which there are about 1,000 inmates and employes. This institution has its own water supply and sewer system and therefore does not affect the municipal works. The city of Beacon was incorporated as a city with a commission form of government in 1913, and the city includes the former incorporated villages of Matteawan and Fishkill Landing as well as some of the adjacent unincorporated portions of the town of Fishkill. The estimated population at the time of the inspection was about 12,000, while at the last census in 1910 the population was 11,040.

The public water supply of the village is obtained from a mountain stream and reservoir and a portion of the supply is also taken from Fishkill creek. This latter supply is treated with hypochlorite of lime before it is used. The water from the main supply is delivered to the city by gravity, while that from the creek requires pumping. About 70 per cent. of the population, or 8,400, are served by this water supply. The daily consumption as obtained from the office of the water department amounted to about 260,000 gallons per day and was equivalent to 31 gallons per capita. This per capita consumption is considered very low, and it is quite probable that the actual consumption would be somewhat higher.

The sewer system of the city consists of about 20 miles of sanitary sewers and serves about 90 per cent., or 10,800, of the residents. There are about 12 miles of the sewers which lead to the sewage disposal works. The remaining

portion of the sewers discharge directly into the Hudson river through two outlets, the larger being under the dock at the ferry and the small one discharging at low water line at the foot of Denning avenue. The sewers leading to the disposal plant vary in size from 8 to 24 inches, and for some distance the main sewer flows through the bed of or adjacent to Fishkill creek.

This disposal plant was constructed originally for the village of Matteawan and serves about 38 per cent. of the entire population of the city, which would correspond to about 4,500 people. The quantity of sewage flowing at the time of inspection amounted approximately to 1,358,500 gallons per day. This amount of sewage flow is equivalent to a per capita flow of about 302 gallons, and it was estimated that nearly two-thirds of the flow was due to ground water.

The sewage disposal plant was designed by D. L. Merritt, civil engineer, the plans being approved by this Department on July 25, 1906. The plant was constructed in 1907 under the supervision of D. L. Merritt.

The effluent from the plant is discharged into Fishkill creek, a tributary of the Hudson river. The area of this creek above the discharge of the effluent is about 204 square miles. The flow of water at the time of the inspection amounted to approximately 176 cubic feet per second, or a flow of .86 cubic feet per second per square mile. This flow corresponds to a dilution of 39 cubic feet per 1,000 population contributing sewage to the disposal plant. The probable minimum flow is about 40 cubic feet per second, or .2 cubic feet per second per square mile. These figures were obtained from the United States Geological Report for the years 1901 and 1902. This minimum flow is equivalent to a dilution factor of 6 cubic feet per second for 1,000 contributing sewage. The water in this stream below the discharge of sewage is not used for any public water supply purposes and receives a small amount of factory wastes from mills along the creek.

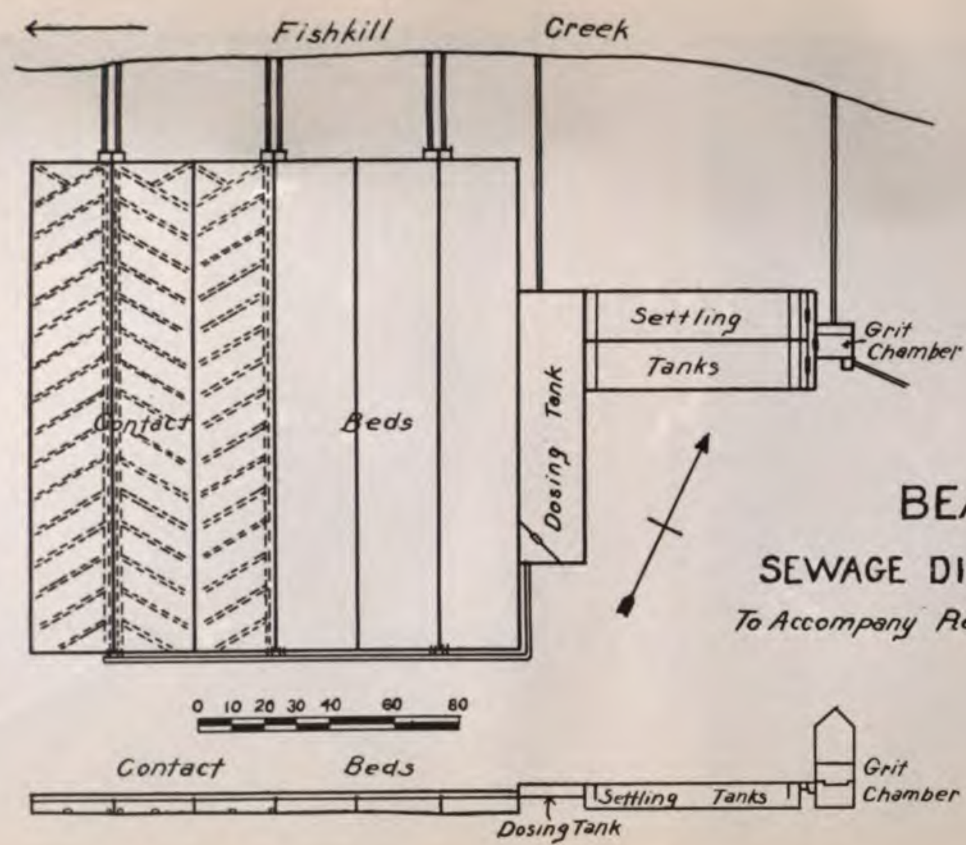
Description of sewage disposal works

The disposal plant consists of a grit chamber, two settling tanks and six contact beds.

Site.— The plant is located in the southern part of the city on the south bank of Fishkill creek and is about 1¼ miles from the Hudson river. The location is well remote from any residences, there being only one house near the plant and that about 500 feet distant. Opposite the plant on the other side of the creek is a small mill where rubber goods are manufactured.

Grit chamber.— The grit chamber is contained in a house 16 feet square and the chamber itself is 16x10 feet in plan and has a depth of 7½ feet. The remaining portion of the house is taken up by a sludge well which is 16x3 feet in plan. Connecting these two tanks is a 24-inch pipe and the flow in this pipe is controlled by a 24-inch gate. The influent pipe to the grit chamber is 24 inches in diameter and is at the surface of the sewage in the chamber. At the opposite end of this chamber is the effluent weir, which is five feet long. A scum board is placed in front of the weir to prevent scum or floating substances from passing to the distributing channel. The capacity of this chamber is about 8,580 gallons, and with the amount of sewage flowing at the time of the inspection it would give a theoretical detention period of about nine minutes.

Settling tanks.— The two settling tanks are constructed of concrete and are 65x21 feet in plan and 6 feet deep. These tanks are open, although the approved plans called for a roof over the tanks. The capacity of these two tanks is about 122,800 gallons. The approved plans called for a 1-foot stop plank to be inserted at the effluent weir, which would increase the capacity of the tanks to 143,300 gallons. The distributing channel, receiving the sewage from the grit chamber, extends along the eastern ends of the tanks and distributes the sewage to either or both of the settling tanks. The west end walls of the tanks act as weirs, over which the sewage passes to the dosing chamber. Scum baffles are provided in front of the influent and effluent weirs. Provision is made and the plans call for a 2-inch plank one foot high to be installed at the effluent weir to give an additional depth in the tank of one



BEACON

SEWAGE DISPOSAL PLANT

To Accompany Report of June 8 1915

Cost and operation of plant.—The disposal plant cost about $39,000. The superintendent of water and sewers has general charge of the plant, and it was estimated that the yearly maintenance of the plant was in the neighborhood of $250.

Efficiency of plant as determined by chemical analyses

In order to determine the efficiency of the disposal plant to properly treat the sewage contributed to it, and also as a test of the operation of the different units comprising the plant, analyses were made of the sewage and of different effluents and of the river water into which the effluent was discharged. The report of these analyses, which include the temperature of the sample, gives the results of the tests for settling, turbidity, oxygen consumed, dissolved oxygen, nitrates, chlorine and putrescibility, and these results are shown in the following table:

Table of Analyses Made on April 7, 1915

	Temperature	Imhoff cone c. c. in 1 hour	Parts Per Million						Putrescibility, days
			Turbidity	Oxygen consumed, 10 min. boiling	Dissolved Oxygen		Nitrates	Chlorine	
					Parts	Per cent of saturation			
Raw sewage	44°	0.4	35	21	4.9	40	1.2	12	2½
Tank effluent	44°	0.15	35	17	4.9	40	....	12	2½
Contact bed effluent	44°	......	*	8.4	4.9	40	1.4	12	sample lost
Stream above	44°	......	Clear	4.0	6.1	50	....	2.9	Over 20
Stream below	44°	......	Clear	4.0	6.2	51	....	3.2	Over 20

* Slightly turbid

While the results of these analyses may not represent average results of operation of the plant over a long time, especially since the contact beds were not being operated as such, they do nevertheless show clearly the condition at the time of inspection, which may be stated as follows:

The raw sewage as received at the time of the inspection appeared to be about one-quarter of the strength of the average day flow of domestic sewage of a municipality of this size. This result is shown by the settling, turbidity, oxygen consumed and chlorine tests. The 4.9 parts of dissolved oxygen is high for a raw sewage and plainly shows the fresh character of the same. The 1.2 parts of nitrates was undoubtedly due to the large amount of ground or creek water which had entered the sewers. The stability of 2½ days in the putrescibility test also shows the weakness of the sewage.

The tank effluent contained 0.15 cubic centimeters of readily settling matter, as compared with the .4 c. c. found in the raw sewage. This showed a reduction of settling matter of about 62 per cent. The turbidity of 35 parts was the same as that of the raw sewage. The oxygen consumed test gave 17 parts, as compared with the 21 parts in the raw sewage, and showed a removal of about 19 per cent. of organic matter. The dissolved oxygen, chlorine and putrescibility tests gave the same results as those of the raw sewage, and all the tests plainly indicated the comparatively little reduction of the sewage in passing through the tank.

Considering next the effluent from the contact beds, the results of the turbidity and oxygen consumed tests plainly indicated the straining effect performed by the beds, in which the turbidity was reduced from 35 parts to a

slightly turbid effluent and the oxygen consumed from 17 to 8.4 parts. This reduction in oxygen consumed represented the removal of organic matter of about 50 per cent. The dissolved oxygen still contained 4.9 parts and showed no reduction in passing through the tanks. The nitrate test of 1.4 parts, as compared with the 1.2 parts in the raw sewage, showed an increase of .2 of a part and is undoubtedly due to the normal nitrification taking place due to the dissolved oxygen present and not to any nitrification performed by the contact beds. The chlorine of 10 parts was the same as that of the raw sewage and of the tank effluent.

The stream above the discharge of the effluent was clear and gave 4 parts of oxygen consumed, 6.1 parts of dissolved oxygen, 2.9 parts of chlorine, and was stable in the putrescibility test. These tests showed comparatively little pollution of the creek water above the disposal plant.

The results of analyses of water from the creek below the discharge of the effluent, with two exceptions, were the same as in the case of analyses made of the stream above, and this condition was obviously due to the large dilution of the effluent taking place at the time of the inspection. The principal increase was found in the chlorine test, in which the chlorine increased from 2.9 parts to 3.2 parts and showed plainly the addition of the effluent to the creek water.

The effluent from the contact beds is discharged on the bank of the creek about two feet above the surface of the water. This effluent flows over the ground for 5 or 10 feet and the stones over which the effluent flows were covered with a sewage fungi and algae growth. It was stated by the men in the mill below the point of discharge of the effluent that at times during the summer the odors from the disposal plant are very disagreeable, although at the time of the inspection, due to the large flow in the creek, the odors were not noticeable except in the immediate vicinity of the plant.

Summary and conclusions

As a result, then, of the investigation of this plant, and after a careful consideration of the condition of operation and the results of analyses of the effluent from the various parts of the plant, and of the creek water, the following summary and conclusions are presented:

1. The large amount of creek water which enters the sewer tends to greatly overtax the plant, although not necessarily increasing the organic matter.
2. The capacity of the two settling tanks is entirely inadequate to sufficiently settle out much of the suspended matter contained in the raw sewage, especially since the tanks were found to be practically full of sludge.
3. The lack of automatic feed and timed siphons results in an inefficient operation of the contact beds, since they were acting as coarse strainers instead of as contact beds.
4. The capacity of the contact beds is entirely too small to treat the amount of sewage contributed to them, the sizes of the stones in the beds are too large to effectively treat the tank effluent, and the beds were nearly full of sludge.
5. The method of sludge disposal by discharging the same into the creek is insanitary and unsatisfactory, and the sludge bed shown on the approved plans was never constructed.

Recommendations

In view of the results of this investigation, I would recommend that the city authorities be requested to make the following changes in the sewer system and disposal plant in order that the effluent may be discharged at all times into the creek in a satisfactory condition:

1. That an effort be made to reduce the amount of ground or creek water which enters the sewer system

2. That the third settling tank as called for by approved plans be constructed and that the maximum depth of 7 feet be maintained at all times in these tanks

3. That at no time should more than one-third of the capacity of the settling tanks be occupied with sludge and scum

4. That the other two contact beds as shown on the approved plans be constructed and that the depth of the stone in all beds be increased to 5 feet

5. That the filtering stone of the contact beds be removed and that stone of the size called for by the approved specifications be placed in the beds

6. That automatic feed and timed siphons as called for by the approved plans be installed in connection with the contact beds

7. That a proper method of sludge disposal be provided and that under no circumstances shall any sludge or scum be discharged into the creek.

Furthermore, since it is evident that the plant was not constructed in accordance with the approved plans and has never been placed or maintained in an efficient operating condition, I would recommend that the city be requested to make the above changes in the construction and operation of the plant at the earliest possible date.

Respectfully submitted,

THEODORE HORTON,
Chief Engineer

ALBANY, N. Y., *June* 18, 1915

CORNWALL (Stone School)

HERMANN M. BIGGS, M.D., *State Commissioner of Health:*

I beg to submit the following report on an investigation of the sewage disposal works at Stone School located near Cornwall-on-Hudson, Orange county, made on April 6, 1915. This investigation was made by Mr. Morton F. Sanborn, assistant engineer, in connection with the general investigation of sewage disposal plants in the State now being carried on and also as a result of the complaints which have been received in regard to the operation of the plant.

Location and general description

Location.— About 1½ miles south of Cornwall-on-Hudson, about 45 miles north of New York City, on the west bank of the Hudson river

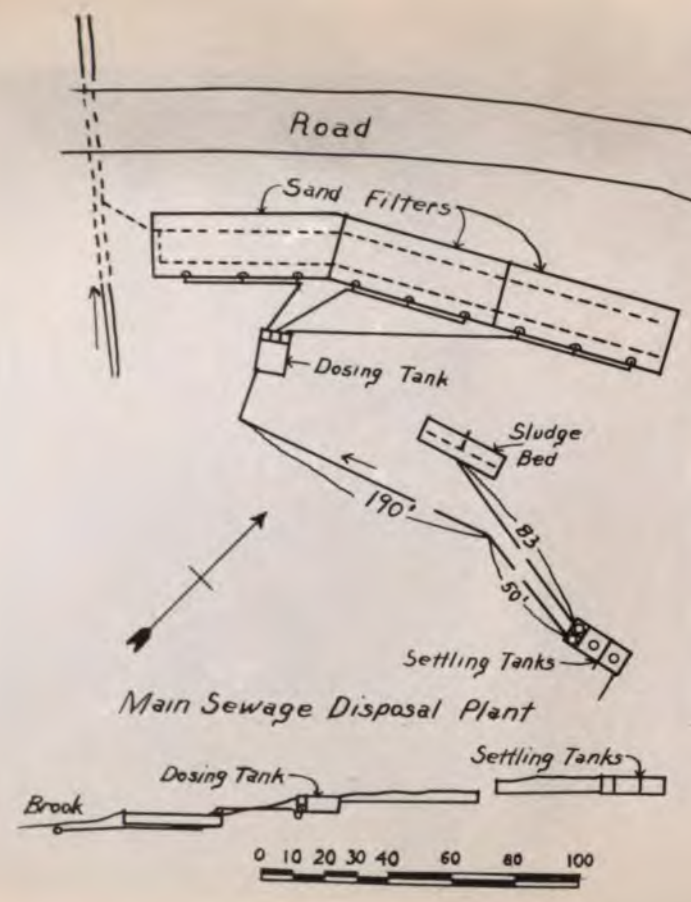
Population.— Eighty at time of inspection

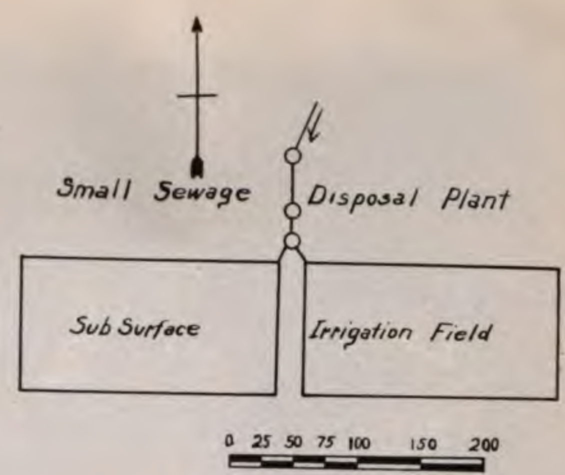
Water supply.— From public water supply of village of Cornwall

Sewer system.— About one-quarter mile of 4-inch tile pipe

Sewage disposal plants.— The main disposal plant consists of two settling tanks, a dosing chamber, three sand filters and a sludge bed. A description of the small plant which receives sewage from the farmer's cottage, the gymnasium and one of the dormitories in which about twenty-five persons sleep will be found in the attached supplementary report.

Stone School is a private school and is under the regents. Boys from eight to twenty years of age are received at the school. Practically all of the boys sleep either in the main building or in the smaller dormitory. The school is located about one and one-half miles south of Cornwall Landing on the main road which passes west of Storm King Mountain, and is about 800 feet above sea level. The number of persons at the school would vary from a population of about ten during the summer to a maximum of about 100. At the time of the inspection the number of persons at the school was about eighty.





CORNWALL ON HUDSON
STONE SCHOOL
SEWAGE DISPOSAL PLANT

To Accompany Report of June 2, 1915.

results of the analyses, together with the efficiency of the different units will be stated as follows:

A sample of the raw sewage before it entered the settling tank could not be obtained since there were no manholes or any places where the sample could be collected. A sample collected and considered as the raw sewage in this report was, therefore, taken from the settling tank close to the inlet to the tank. This raw sewage appeared to have a strength of about 80 per cent. of the day flow of sewage of a small municipality. This was shown by the settling, turbidity, oxygen consumed and chlorine tests. The 1.2 parts of dissolved oxygen indicated that the sewage was in a fresh condition as received at the plant. The putrescibility test showed a stability of eight days and was undoubtedly due to the bleach used in the school buildings which would have tended to prevent any bacterial growth in the sewage.

Considering next the tank effluent it will be seen by the settling test that about 70 per cent. of the readily settling matter was being removed. The turbidity of 300 parts was the same as that of the raw sewage. The oxygen consumed test gave 60 parts as compared with the 82 parts of the raw sewage. This showed a reduction of 28 per cent. The dissolved oxygen was the same as that of the raw sewage and was probably due to the fact that there was little or no bacterial growth going on in the tank. The chlorine test of 50 parts was practically the same as that of the raw sewage. In the putrescibility test, a stability of 5½ days was shown and this long period was undoubtedly due to the action of the bleach. This period of 5½ days as compared with the greater stability of the raw sewage of eight days is undoubtedly due to the fact that the effect of the bleach had partially been reduced and that the bacterial action was slightly greater than in the raw sewage.

The water in the brook above the discharge of the effluent consisted mostly of ground water and melting snow from the surface and had a turbidity of 20 parts. It also gave 4.5 parts of oxygen consumed, 5.5 of chlorine and 5.9 of dissolved oxygen. The sample in the putrescibility test was stable. These analyses indicate a small amount of pollution, apparently due to the run-off from the ground.

Since the effluent from the sand filters was discharged into the brook as it passed through the covered culvert no sample of the same could be obtained and, therefore, a sample had to be taken of the stream below the highway. This combined brook water and effluent showed a turbidity of 25 parts as against a turbidity of 20 parts of the brook water above. This increase was probably due to the turbidity of the effluent as it united with the brook water. 7.2 parts of oxygen consumed were obtained as compared with the 4.5 parts in the stream above. This showed an increase of 2.7 parts which was due to the effluent from the plant. This test would indicate that the oxygen consumed if determined in a test of the sand filter effluent would show approximately 10 parts of oxygen consumed since it was estimated that the quantity of effluent was approximately the same as that of the water in the brook and, therefore, would give a combined sample of about equal parts of brook water and effluent. The dissolved oxygen test gave 5.7 parts as compared with that of the 5.9 parts of the stream above and showed a reduction of 0.2 due to the lesser amount in the effluent. In the nitrates test 2 parts were obtained, which indicated that only a small amount of nitrification was taking place in the filters. This poor nitrification was probably due to the fact that the plant was started and has been operated only during the winter, and also to the bleach used in the school buildings which would have prevented sufficient bacterial action to obtain a good nitrification. The 36 parts of chlorine as compared with the 5.5 parts in the brook water above plainly showed the addition of the effluent, since the chlorine test would be a true indication of the presence of the effluent. In the putrescibility test a stability of only five days was obtained, which is very low for a sand filter effluent. This is also probably due to the same reason as stated for the low nitrification, since the organic matter had not been sufficiently oxidized and nitrified and, therefore, the effluent probably would be putrescible.

The bed in the stream below the discharge of the effluent from the plant did not appear to show any evidence of the presence of the effluent by odors or by any growths due to the effluent. This is probably due to the large dilution

obtained at this time, to the time of the year and also since there would be only about two discharges of the effluent a day and these discharges would only last for an hour or so.

Summary and conclusions

As a result then, of the investigation of this plant and after careful consideration of the condition of operation and the results of analyses of samples from various parts of the plant, the following summary and conclusions are presented:

1. The use of both settling tanks in series gives a detention period of about one day and is decidedly longer than is necessary or desirable.
2. The poor distribution of the tank effluent upon the sand filters and its low rate of application undoubtedly accounts for part of the low efficiency of the sand filters.
3. That the excessive use of bleach in the buildings, while having a germicidal effect on the bacteria, apparently prevents nitrification in the sand filters and, therefore, the effluent was not as good as it should be.
4. Since the plant was only started last December and has been in operation only during the cold weather of the winter it is not to be expected that the plant would be doing its best work by this time, but with the warmer weather of the spring a much better effluent should be produced from the plant and, also, the covering of the filters will undoubtedly assist in producing better conditions for the following winters.

Recommendations

In view of the results of this investigation, I recommend that the authorities of the Stone School at Cornwall be requested to make the following changes in the operation of the disposal plant in order that the plant may at all times be maintained in an efficient operating condition:

1. That only one settling tank be used at a time and the influent and effluent pipes be rearranged so that this may be accomplished.
2. That better and more rapid distribution of the tank effluent on the surface of the sand filters be provided by the construction of distributors and, if possible, by the adjustment of the siphons.
3. That the amounts of bleach used in the buildings be reduced to that amount necessary to maintain sanitary conditions around the sinks, toilets and urinals.

Respectfully submitted,
THEODORE HORTON,
Chief Engineer

ALBANY, N. Y., *June* 8, 1915

Supplementary report describing the small sewage disposal plant at Stone School, Cornwall-on-Hudson

This plant receives sewage from the farmer's cottage, the gymnasium and one of the dormitories in which about twenty-five persons sleep. The plant was constructed about twenty years ago and consists of a receiving manhole, a dosing manhole, a distributing manhole and from 3,000 to 4,000 feet of pipe laid in a subsurface irrigation field.

The plant originally received the sewage from the entire school but about six years ago it was found to be inadequate and, therefore, the main disposal plant on the other side of the hill was constructed to receive the sewage from the main buildings of the school.

This plant is located on the south side of the hill on which the school is located and the effluent flows through the ground and eventually reaches a

brook which flows into the reservoir of the Cornwall water supply about one-half mile below the plant. The receiving manhole, dosing manhole and the distributing manhole are all about four feet in diameter. The irrigation field is provided with two units on the side of the hill. Either or both units may be used at a time. At the time of the inspection, no sewage was noticed flowing through this plant and no evidence was seen of the effluent flowing over the surface of the ground. No test was made of the efficiency of the plant since a sample of the effluent could not be obtained.

Summary and conclusions

The area of this field and the apparent manner in which the plant is operated appeared to be sufficient to properly care for the sewage contributed to it, since the effluent apparently reaches the brook by flowing through the ground and would undoubtedly receive considerable purification.

June 2, 1915

DANSVILLE

HERMANN M. BIGGS, M.D., *State Commissioner of Health:*

I beg to submit the following report on an investigation of the sewage disposal plant of the village of Dansville, Livingston county, made on May 3, 1915. This investigation was made by Mr. Morton F. Sanborn, assistant engineer, in connection with the general investigation of sewage disposal plants in the State now being carried on. A previous investigation was made of this disposal plant in 1907, the report of which is published on page 754 of the 28th Annual Report of the State Department of Health.

Location and general description

Location.— Dansville is located in the southeast corner of Livingston county and is about 40 miles south of Rochester, on the Delaware, Lackawanna and Western railroad and the Dansville and Mount Morris railroad

Population.— 4,000 estimated at the time of inspection

Public water supply.— Municipal supply from Mud and Mill creeks.

Sewer systems.— Twelve miles of sanitary sewers and four miles of storm water sewers

Sewage disposal works.— Grit chamber, settling tank and four contact beds

The village of Dansville is largely a residential and tree nursery district. There are also several manufactories in Dansville, and the Jackson health resort is located on the hill on the east side of the village. There has been a slow but steady increase in the population in recent years, since in 1905 there were 3,633 residents, in 1910 the number had increased to 3,908, and at the time of the inspection it was estimated that the population amounted to about 4,000.

The public water supply of the village is taken from Mud and Mill creeks, which are several miles east of the village. This water is fed to a reservoir which is 1½ miles east of the village, and from there the water flows by gravity into the distributing system. This water is not filtered before being used. About 95 per cent. of the population is served by this water supply. No figures of the daily water consumption could be obtained, since there was no practical method of readily obtaining them.

The sewer system consists of about 12 miles of sanitary sewers ranging from 6 inches to 24 inches in size and four miles of storm water sewers from 8 to 24 inches in size. About 70 per cent., or 2,800, of the population are served by the sewer system and disposal works. The approximate daily flow of sewage as measured at the disposal plant was about 756,000 gallons per day. This flow corresponds to an average per capita flow of those served by the plant of about 270 gallons per day. There is probably very little trade

wastes entering the sewers and there is probably considerable ground water in the sewage.

The disposal plant was designed by Knight & Hopkins, civil engineers of Rome, N. Y., and the plans were approved by this Department on May 31, 1904. The works were constructed by Eveline & Baltimore of Waterford under the direction of Knight & Hopkins and were completed and placed in service in the year 1907.

The effluent from the disposal plant is discharged into Canaseraga creek, which is a tributary of the Genesee river. The area of the watershed above the discharge of the effluent is about 175 square miles. At the time of the inspection the flow in the creek amounted to approximately 144 cubic feet per second, which is equivalent to .83 cubic feet per second per square mile. This flow is also equivalent to a dilution factor of about 52 cubic feet per second for 1,000 population contributing sewage. The minimum flow in this creek is probably about 35 cubic feet per second, which would correspond to .2 cubic feet per second per square mile, and would give a dilution factor of about 12.5 cubic feet per second for 1,000 population contributing to the disposal plant. The waters of this creek are not used for any public water supply, nor is there any other system of sewers which discharge into the creek.

Description of sewage disposal plant

The disposal plant consists of a grit chamber, a settling tank and four contact beds.

Site.— The plant is located in the northwestern part of the village, about 700 feet from the highway and 600 feet from the creek. It is situated on low land, and about one year ago the contact beds were flooded by the waters of the creek during an extremely high freshet. This is said to be the first time the plant has been flooded, although at times the water in the creek rises above the bottom of the beds. There are no residences located near the plant.

Grit chamber.— The grit chamber and settling tank are built as one structure and are constructed of concrete throughout. The floors and sides are of plain concrete and the roof of plain concrete reinforced with 8-inch "I" beams spaced 6½ feet apart.

The grit chamber is 6x30 feet in plan and has an available depth of 7½ feet. The capacity of the tank is about 10,125 gallons, and with the amount of sewage flowing as found during the inspection a theoretical detention period of about 19 minutes would be obtained. The sewage enters the grit chamber through a 24-inch pipe and is discharged in a downward direction about two feet below the surface. Adjacent to the influent pipe and near the bottom of the chamber is located a 12-inch pipe which leads to the by-pass at the receiving manhole located about 20 feet from the chamber. One-half of the side of the grit chamber next to the settling tank forms a weir, over which the sewage passes to the tank. Sludge drains extending through the settling tank lead to the grit chamber, which is used as a sludge pump well. The chamber was well filled with sludge and scum, which prevented an efficient settling of the heavier suspended matter.

Settling tank.— The settling tank is 92½x30 feet in plan and is divided longitudinally by an 18-inch wall which extends from the north end to within about 15 feet of the south end of the tank. This wall divides the tank in such a way as to form a tank having an effective length of 185 feet and a width of 14¼ feet. The average depth of the tank is about six feet and has a capacity of about 110,600 gallons. This capacity would give a theoretical detention period of about 3½ hours with the amount of sewage flowing as found during the inspection. The easterly half of the north end of the tank forms a weir, over which the sewage flows from the grit chamber into the settling tank. Located in the north end of the other half of the tank is a 16-inch cast iron effluent pipe which extends across the end of the tank and along the east side to the receiving basin at the feed siphons. This pipe is located at about mid-depth in the tank, and in the pipe at the end of the tank there are two "T's" through which the sewage passes.

Sludge is removed from this tank once or twice a year, although the scum has never been removed. The depth of scum and sludge in the tank at the time of the inspection varied from four feet of scum and one foot of sludge at the influent end to about one foot of scum and one foot of sludge at the effluent end. This excessive amount of sludge and scum would therefore reduce the detention period more than one-half of that of the theoretical period and would give a detention period of only about 1½ hours, which is too short a period for this type of tank.

Dosing chamber.— The dosing chamber is contained in a concrete house 8x40 feet in plan and is located adjacent to the settling tank. In this house were four United States Shields automatic 12-inch feed siphons. Each siphon discharges to its corresponding contact bed. These siphons consist of a plunger valve and air chamber, and it was stated by the superintendent that under ordinary conditions the siphons worked efficiently. At the time of the inspection, however, only one bed was being used, since the stone in two of the beds was being cleaned and the siphon for that bed in operation was fastened so that it remained open.

Contact beds.— The four contact beds are from 21 to 26 feet wide and from 194 to 210 feet long. The beds have an average area of about 4,780 square feet and give a total area of about .44 of an acre. The sides and bottoms of the beds are of concrete and the filtering material consists of 2½ feet of broken stone from ½ to 1½ inches in size. The distribution system consists of one line of one-half round 15-inch pipe laid on the surface and along the center of the bed. The underdrains consist of two lines of 12-inch tile pipe without bells, there being one line along each side of the bed. These drains lead to the timed siphons, which are at the opposite ends of the beds from the feed siphons. With the amount of sewage flowing at the time of the inspection the rate of treatment would be about 1,740,000 gallons per acre per day, which is equivalent to 696,000 gallons per acre per foot in depth per day.

Considering the void spaces in the stone as being about 33 per cent. of the total volume, each bed would have about six fillings a day. This would give a rate of filtration much greater than that for which the contact beds were designed, and the approved plans called for a duplicate plant whenever the flow of sewage had increased to more than 350,000 gallons per day.

About a year ago an extra high freshet flooded the contact beds and deposited on them a considerable amount of sand and silt. After the flow had subsided about three inches the silt and stone were removed. This did not give complete satisfaction, and this year it was decided to clean all the stone in the beds. This washing had been in progress about one week before the arrival of the inspector and about 8 per cent. of the stone had been washed. The stone was being cleaned by placing it in 6-inch layers on a wooden platform supported about eight inches above the bottom of the bed and washing it with water discharged from a nozzle. The dirt and sand washed away from the stone passed down through openings between the planks to the concrete floor, from where it was removed to fill low areas near the plant. At the time of the inspection the stone in two of the beds was being washed and only one bed was in use. In this bed the sewage flowed over the surface of the stone nearly to the timed siphon, then down through a hole in the filtering stone to the underdrains and out to the creek. This would, therefore, give practically no purification, except possibly a little due to the settling out of suspended matter.

Timed siphons.— The four timed siphons, one to each bed, are located in two concrete houses at the west end of the contact beds. These siphons are supposed to discharge the effluent from the beds after it has remained standing in them a predetermined time. Due to the use of only one of the beds the siphons were not operating and the siphon of the bed in use was fastened open.

Sludge disposal.—A sludge pump house of concrete 16 feet square was constructed adjacent to the grit chamber. This house was supposed to have a pipe extending down into the grit chamber or sludge pump well, but it was not placed during the construction of the plant. A centrifugal pump having

a 6-inch suction and 5-inch discharge is placed near the grit chamber and sludge from the tank is pumped and discharged on the low land adjacent to the plant. The pump is operated by a steam roller which is used temporarily for this purpose. Sludge is removed once or twice a year, although the scum had never been removed.

Cost and operation of plant.— The entire cost of the sanitary and storm water sewers and the disposal plant was about $100,000. The disposal plant itself cost about $18,000 and the four acres of land on which the plant is located cost about $1,600.

The superintendent of water and sewers has general charge of the sewers and disposal plant, and such laborers as are required in the operation of the plant are employed from time to time. It was estimated that the average yearly cost of operation of the plant had been about $100, although the cost of cleaning the stone will raise the average yearly cost $100 or $200.

Efficiency of plant as determined by chemical analyses

In order to determine the efficiency of the disposal plant to properly treat the sewage contributed to it, and also as a test of the different units comprising the plant, analyses were made of the sewage, of the different effluents and of the water of the creek into which the effluent was discharged. The report of these analyses, which include the temperature of the sample, gives the results of the tests for settling, turbidity, oxygen consumed, dissolved oxygen, nitrates, chlorine and putrescibility, and these results are shown in the following table:

ANALYSES MADE ON MAY 3, 1915

	Temperature	Imhoff cone c. c. in 1 hour	Parts Per Million							Putrescibility, days
			Turbidity	Oxygen consumed, 10 min. boiling	Dissolved Oxygen		Nitrates	Chlorine		
					Parts	Per cent of saturation				
Raw sewage	51°	3 0	80	62	0 6	6	.4	25		3/4
Tank effluent	51°	0 5	75	33	0 9	8	....	25		2
Contact, bed effluent	54°	0 2	65	32	1 8	17	.4	30		2
Creek above	57°	......	25	2 9	5 6	51	....	3 5		Over 20
Creek below	58°	......	....	7 5	4 7	40	....	6		Over 20

While the results of these analyses may not represent average results of operation of the plant over a long time, especially since the contact beds were not being operated, they do nevertheless show clearly the conditions at the time of the inspection, which may be stated as follows:

The raw sewage as received on the day of inspection was approximately one-half of the strength of the average day flow of domestic sewage of a municipality of this size. This was shown by the results of the settling test and by the turbidity, oxygen consumed, chlorine and putrescibility tests. The .6 parts of dissolved oxygen indicated that the sewage was in a fresh condition as received at the plant. The .4 parts of nitrates was undoubtedly due to the excessive amount of ground water contained in the sewage.

The tank effluent gave .5 cubic centimeter of readily settling matter, as compared with the 3.0 c. c. found in the raw sewage. This reduction indicated a removal of such readily settling matter of about 83 per cent. The turbidity of 75 parts, as compared with the 180 parts in the raw sewage, indicated a removal of about 42 per cent. The oxygen consumed test of 33 parts, as compared with the 62 parts in the raw sewage, indicated a reduction in organic

matter of about 47 per cent. The 0.9 parts of dissolved oxygen was probably due to a slight amount of aeration the tank effluent received as it flowed out upon the contact beds. The chlorine result of 25 parts was the same as that of the raw sewage. In the putrescibility test a stability of two days was obtained, and this interval of stability was probably due to the weak character of the sewage.

Considering next the contact bed effluent, which is the tank effluent affected by a slight amount of aeration and sedimentation, it will be seen that the results are practically the same as those obtained in the test of the tank effluent. The principal change was in a reduction of readily settling matter from .5 c. c. parts to .2 c. c. This removal of readily settling matter also reduced the turbidity from 75 parts to 65 parts. Otherwise the effluents were practically the same. This test cannot be considered a fair test of the efficiency of the contact bed, since it was not operating as such, and the sewage simply flowed over the surface of the bed without even any straining action.

The stream above the discharge of the effluent had a turbidity of about 25 parts and was due to the character of the soil through which the creek flowed. The 2.9 parts of oxygen consumed and the 3.5 parts of chlorine obtained in the tests indicated little or no pollution. The 5.6 parts of dissolved oxygen found corresponds to a 51 per cent. saturation. In the putrescibility test the creek water was found to be stable.

The sample of creek water taken one-quarter mile below the discharge of the effluent does not represent the average condition of the water, since the creek is a broad, shallow stream with no changes of flow which would cause a thorough mixing of the creek water and effluent. The sample was taken on the east side of the creek, which is the same side on which the sewage was discharged. The 7.5 parts of oxygen consumed obtained in the test plainly indicates the addition of the effluent from the plant by the increase from 2.9 parts to 7.5 parts. The chlorine increased from 3.5 to 6 parts and also showed the addition of the effluent. In the dissolved oxygen test 4.7 parts were obtained, as compared with the 5.6 parts in the stream above. This reduction is due to the small amount of dissolved oxygen in the effluent from the plant. In the putrescibility test the sample was found to be stable. In these tests of the creek water below the discharge of the effluent the results probably indicate a greater amount of pollution than the average, due to the wash water from the stone cleaning operation which was being discharged with the effluent from the plant.

The bed of the creek along the east bank plainly indicated the presence of the effluent by the sewage fungus growth seen on the bed of the creek which extended for a considerable distance down the right bank of the creek. The presence of the effluent was also indicated by the milky and dark color caused by the sewage and by suspended matter which had settled on the bottom of the creek.

Summary and conclusions

As a result, then, of the investigation of this plant, and after a careful consideration of the condition of the plant as found at the time of the inspection and the results of analyses of the effluent from the different parts of the plant and of the creek water, the following summary and conclusions are presented:

1. The excessive amount of ground water contained in the sewage greatly overtaxes the capacity of the plant and especially the contact beds.
2. The excessive amount of scum and sludge in the grit chamber and settling tank prevented effective sedimentation of the readily settling matter contained in the sewage, and a considerable amount of this suspended matter was carried to the contact beds and creek.
3. Due to the cleaning of two of the beds the other beds could not be operated as contact beds and care for all the sewage, and therefore the sewage was passing continuously over the top of one bed and out through the drains to the creek. This operation naturally resulted in a decidedly inferior effluent.

Recommendations

In view of the results of this investigation, I would recommend that the village of Dansville be requested to make the following changes in the sewer system and disposal plant in order that the plant may at all times be capable of properly treating the sewage contributed to it and that the plant may be operated at all times in an effective manner:

1. That steps be taken to reduce the excessive infiltration of ground water into the sewer system in order that the necessity of constructing a duplicate disposal plant, as called for by the approved plans, may be deferred.
2. That the sludge and scum in the grit chamber and settling tank be removed and that the plant be at all times so maintained that not more than one-third of the capacity of these chambers shall be occupied with sludge and scum.
3. That the contact beds be placed in an efficient operating condition as soon as possible and that they be operated at all times as contact beds.

Respectfully submitted,

THEODORE HORTON,
Chief Engineer

ALBANY, N. Y., *June* 10, 1915

EAST AURORA

HERMANN M. BIGGS, M.D., *State Commissioner of Health:*

I beg to submit the following report on an investigation of the sewage disposal plant of the village of East Aurora, Erie county, made on May 5, 1915. This investigation was made by Mr. Morton F. Sanborn, assistant engineer, in connection with the general investigation of sewage disposal plants in the State now being carried on and especially as a result of a complaint which had been received in regard to the operation of the disposal plant:

Location and general description

Location.—About 11 miles southeast of Buffalo, on the Pennsylvania railroad, Buffalo and Alleghany division

Population.— The estimated population at the time of inspection was about 3,500

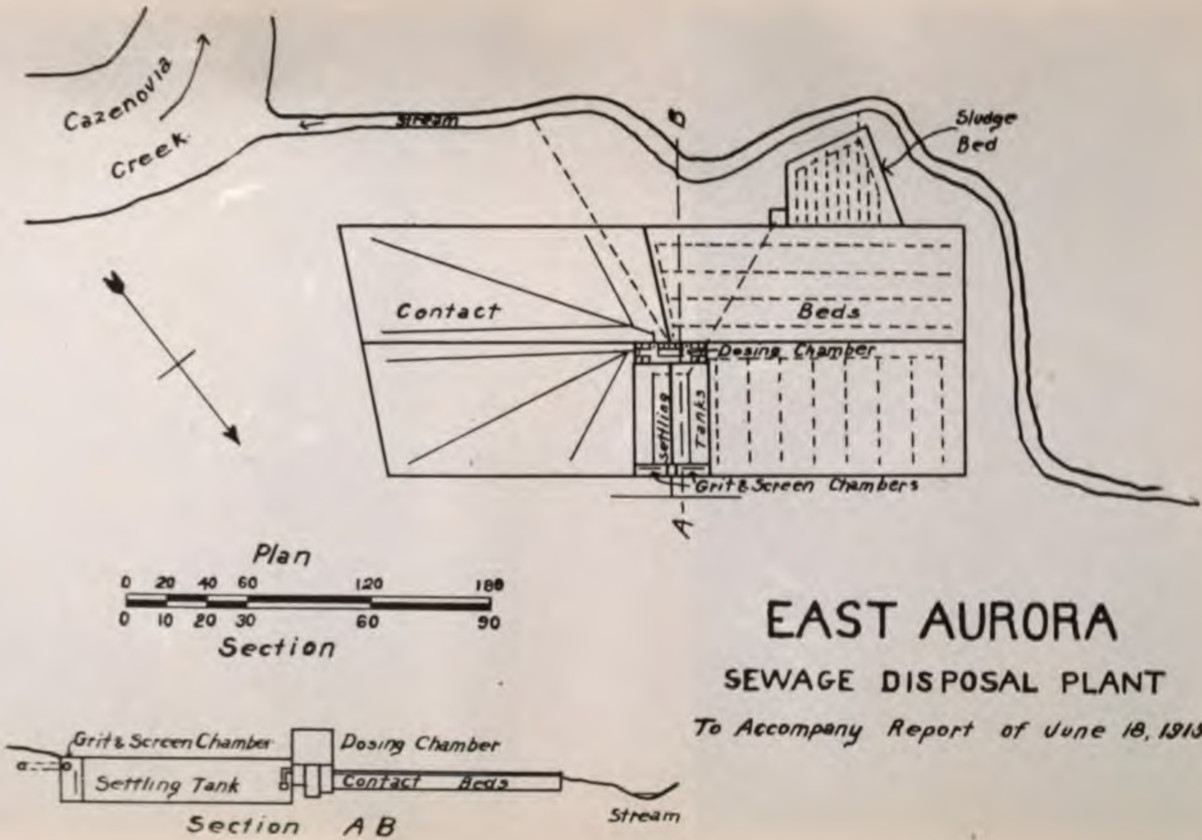
Public water supply.— Municipal supply from driven wells

Sewer system.— Sixteen miles of sanitary sewers

Sewage disposal works.— Two grit chambers, two settling tanks, a dosing chamber, four contact beds and a sludge bed.

East Aurora is largely a residential village, although there are a few small industries in the village. There has been a steady increase in population in recent years, since, according to the census, there were 2,448 inhabitants in 1905, in 1910 the number had increased to 2,781, and at the time of the inspection it was estimated that the number was about 3,500.

The public water supply of the village is obtained from 17 wells which vary from 22 to 26 feet in depth. These wells are located in two groups, one in the northern and the other in the southern part of the village. The water is pumped to the distributing mains and is used without filtration. About 90 per cent., or 3,150, of the inhabitants are served by this water supply. The daily consumption as obtained from the village office, varies from about 227,000 gallons per day during the winter to 400,000 gallons per day during the summer. This total consumption will, therefore, give a per capita consumption varying from 72 gallons during the winter to 127 gallons during the summer.



EAST AURORA

SEWAGE DISPOSAL PLANT

To Accompany Report of June 18, 1915

end of the effluent pipe is only about 75 feet from the main creek. The refuse in the village dump had entirely covered the end of the effluent pipe and the effluent could be seen issuing from underneath the dump at various places and would then pass on down the stream to the main creek. The effluent pipe should be extended to the main creek, which is only about 75 feet distant, and thus do away with the insanitary conditions existing in the small stream due to the discharge of the effluent.

Sludge disposal.—A sludge bed about 35x44 feet in size is located west of the contact beds. This bed contains about three feet of sand and is surrounded by an embankment. Three-inch tile drains are laid through the bottom of the sand about five feet between centers and the effluent from the bed is discharged into the stream. The sludge from the settling tank is received in the manhole located south of the sludge bed and from there it is pumped by a 3-inch hand diaphragm pump to the sludge bed. This bed is too small to receive the entire contents of the settling tanks, and therefore part of the sludge has to be discharged to the bed, dried and removed before more of the sludge can be placed on the bed. It was stated by the superintendent that it was their intention to enlarge this bed in the near future by utilizing part of the surface of the village dump for the enlarged bed. Sludge had been removed from the bed by farmers and used by them as fertilizer.

Cost and operation of plant.—The sewer system cost about $77,200, the disposal plant cost $24,000 and the land on which the plant is located cost about $1,000. The plant is under the direct charge of the superintendent of streets, and it was stated by him that he visits the plant every day to see that it is operated properly.

Efficiency of plant as determined by chemical analyses

In order to determine the efficiency of the plant to treat properly the sewage contributed to it, and also as a test of the different units comprising the plant, analyses were made of the sewage, of the different effluents and of the water of the creek into which the effluent was discharged. The report of these analyses, which include the temperature of the samples, gives the results of the tests of settling, turbidity, oxygen consumed, dissolved oxygen, nitrates, chlorine and putrescibility, and the results are shown in the following table:

ANALYSES MADE ON MAY 5, 1915

	Temperature	Imhoff cone c. c. in 1 hour	Parts Per Million						Putrescibility, days
			Turbidity	Oxygen consumed, 10 min. boiling	Dissolved Oxygen		Nitrates	Chlorine	
					Parts	Per cent of saturation			
Raw sewage	48°	0.6	65	37	2.5	22	0.5	35	1 5/6
Tank effluent	48	Trace	65	24	2.5	22	....	35	1 3/4
Contact bed, 12 M.	*48	......	....	....	*0.0	*0	....	*35	*7/8
Effluent, 2 P. M.	†48	......	....	†12	†2.1	†18	†1.4	....	21/8
Creek above	52	......	Clear	3.3	5.2	48	....	4.5	Over 20
‡Creek below	52	......	Clear	3.3	5.2	48	....	7.0	Over 20

* Sample from bed operating as coarse strainer.
† Sample from bed operating as contact bed.
‡ Sample taken during discharge of effluent.

While these results may not represent average conditions of operation of the plant over a long time, they do nevertheless show clearly the efficiency of the different units of the plant at the time of the inspection. The results of

these analyses, together with the efficiency of the different units, will be stated as follows:

The raw sewage as received on the day of inspection appeared to be about one-third of the average strength of a domestic sewage of a municipality of this size. This was indicated by the settling, turbidity, oxygen consumed, chlorine and putrescibility tests. The 2.5 parts of dissolved oxygen clearly indicated the fresh character of the sewage. The .5 parts of nitrates was evidently due to the large amount of ground water contained in the sewage, which would cause a small amount of nitrification as long as the sewage remained in a fresh condition.

The tank effluent gave only a trace of settling matter and showed efficient removal of readily settling matter, which was undoubtedly due to the short time the tank had been in operation. The turbidity remained the same as found in the raw sewage. In the oxygen consumed test 24 parts were obtained, as compared with the 37 parts in the case of the raw sewage. This test indicated the removal of about 35 per cent. of organic matter. The dissolved oxygen, chlorine and putrescibility tests showed practically the same results as in the case of the raw sewage.

Considering next the effluent from the contact beds, two tests were made, one at noon, which gave an effluent from the bed acting as a strainer, and one at 2 p. m., which was the effluent from a contact bed operating as such. The sample of the strained effluent contained no dissolved oxygen and indicated septic condition in the bed. The chlorine was the same as that obtained in the raw sewage and tank effluent. In the putrescibility test the sample was stable for only seven-eighths of a day and was evidently due to the absence of dissolved oxygen in the effluent.

The effluent from the contact bed taken at 2 p. m. gave 12 parts of oxygen consumed, as compared with the 24 parts in the tank effluent, and indicated a reduction of 50 per cent. of organic matter. In the dissolved oxygen test 2.1 parts were obtained and indicated that the effluent was in a fresh condition. In the nitrates test 1.4 parts were obtained, as compared with the .5 part in the raw sewage. This test indicated that nitrification was going on in the bed, although not so much as should have been if all beds had been working properly. In the putrescibility test a stability of 2⅛ days was obtained and indicated a stability slightly greater than that of the tank effluent. This increase was undoubtedly due to the smaller amount of organic matter and to the nitrates contained in the effluent.

The main creek above the discharge of the effluent was clear and contained 3.3 parts of oxygen consumed. The dissolved oxygen test gave 5.2 parts, which corresponded to a 48 per cent. saturation. In the chlorine test 4.5 parts were obtained. The putrescibility test gave a stability of over 20 days.

The main creek below the discharge of the effluent was also clear and contained 3.3 parts of oxygen consumed. This result was the same as that found in the creek water above. Five and two-tenths parts of dissolved oxygen was obtained, which was also the same as that of the creek water above. In the chlorine test 7 parts were obtained, which showed plainly the addition of the effluent from the disposal plant. In the putrescibility test the sample tested was found to be stable, and this result was undoubtedly due to the large amount of dilution given the effluent at that time.

The bed of the small brook for the 75 feet through which the effluent flows showed plainly the effect of the effluent by the dense growth of fungi on the bed of the brook and by the odors of the effluent.

The bed of the main creek for 200 or 300 feet below the discharge of the effluent showed a small amount of sewage fungi and algae growth, which was due to the presence of the effluent in the creek water. This growth was along the side of the creek nearest to the disposal plant. The creek at this place is about 80 feet wide, the bed consists entirely of ledge, and the depth of water in the creek was not over six inches at any point. During periods of smaller flow in the creek the growths on the bed of the creek would naturally be considerably greater. An odor of sewage was evident near the vicinity of the discharge of the effluent, but the odor could not be detected at any great distance.

Summary and conclusions

As a result, then, of the investigation of this plant, and after a careful consideration of operation and results of analyses of the effluent from the various parts of the plant and of the creek water, the following summary and conclusions are presented:

1. The excessive amount of ground water entering the sewers tends to overtax the disposal plant, although not necessarily increasing the organic matter. If this excess is allowed to continue with the addition of new sewers it will not be long before the plant will require to be enlarged in order that the plant may at all times work efficiently.
2. The efficiency of the grit chamber and settling tank could undoubtedly be improved if both grit chambers and settling tanks were used, except at such times as the tanks and chambers require cleaning.
3. The faulty adjustment of the automatic dosing arrangement evidently accounted for the comparatively ineffective treatment of the sewage as shown in the test of the final effluent.
4. The contact period of 20 minutes is smaller than ordinarily allowed and the period should be increased to from one to two hours.
5. The sludge bed is too small to receive the entire contents of one of the tanks, and therefore only part of the sludge from a tank can be dried at a time. This means that the time of exposure of the sludge is increased to three or four times that which should be necessary.
6. The location of the present discharge of the final effluent from the contact beds is very unsatisfactory, as evidenced by the odors and growths on the bed of the small stream and on account of its being covered by the refuse dump.

Recommendations

In view of the results of this investigation, I would recommend that the village authorities be requested to make the following changes in the sewer system and disposal plant in order that the effluent from the plant may at all times be discharged in a satisfactory and stable condition:

1. That every effort be made to reduce the amount of ground water reaching the sewers in order that the village may not be required in the near future to enlarge the plant to treat the excessive amount of sewage and ground water.
2. That both grit chambers and settling tanks be used, except at such times as they should be cleaned, and their use be resumed as soon as possible at such times.
3. That the automatic dosing apparatus be adjusted in order that the contact beds may at all times be operated as intended and that the contact period be increased to from one to two hours.
4. That the area of the sludge bed be enlarged as soon as possible in order that it may receive the entire contents from one settling tank.
5. That the effluent pipe from the contact beds be extended to the main creek.

Respectfully submitted,

THEODORE HORTON,
Chief Engineer

ALBANY, N. Y., *June* 18, 1915

EAST SYRACUSE

HERMANN M. BIGGS, M.D., *State Commissioner of Health:*

I beg to submit the following report on an investigation of the sewage disposal plant in the village of East Syracuse, Onondaga county, made on December 8, 1914. This investigation was made by Mr. Morton F. Sanborn, assistant engineer, in connection with the general investigation of the disposal plar

in the State now being carried on. A previous investigation of the sewage disposal works of East Syracuse was made in 1907 and the report is found on page 760 of the 28th Annual Report of the State Department of Health. The disposal plant inspected at that time has since been abandoned and the present investigation was made of the municipal sewage disposal works now in use, situated in the western part of the village:

Location and general description

Location.— Four miles east of the city of Syracuse, on the New York Central and Hudson River railroad and the West Shore railroad, lying just north of the Erie canal

Population.— 3,500 estimated at time of inspection

Water supply.— Municipal, supplied from springs

Sewer system.— Seven and one-half miles sanitary sewer, 6 to 18 inches in size

Sewage disposal works.— One settling tank and disinfection plant.

East Syracuse is an incorporated village. One of the largest railroad yards in the State is located in the village and a metalware factory at East Syracuse employs from 150 to 500 people. The village has had a slow but steady increase in population in recent years, since in 1905 there were 2,996 inhabitants, in 1910 the population had increased to 3,274, and at the time of the inspection the number was estimated at 3,500.

The public water supply is obtained from springs about seven miles south of the village. It is a municipal supply and the water is used without filtration and flows by gravity to the village. Practically all of the population is served by this water supply. The average daily consumption is about 275,000 gallons, which corresponds to a per capita daily consumption of 79 gallons.

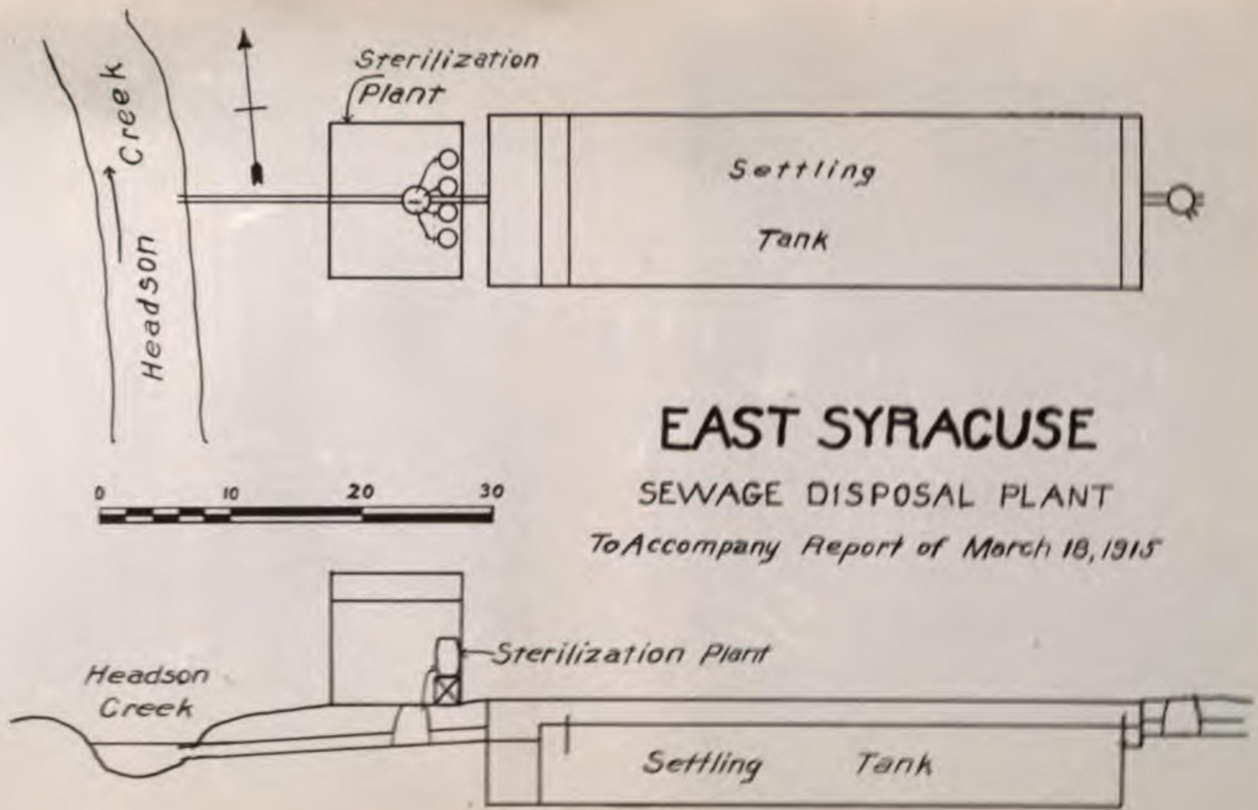
The sewer system consists of about 7½ miles of sanitary sewers varying in size from 6 to 18 inches. About 1,400 of the inhabitants, representing about 40 per cent. of the total population, are served by the sewer system and disposal works. The approximate daily flow of sewage as measured by current meter at the outfall pipe on the day of inspection was 255,000 gallons per day. This flow of sewage corresponds to a daily flow per capita served of 182 gallons, of which it is estimated that about 50 per cent. is due to ground water infiltration.

The disposal plant was designed by Mr. E. D. Smalley, civil engineer, of East Syracuse, and the plans were approved by this Department on February 18, 1909. The plant was constructed by the village under the direction of W. W. Snyder, civil engineer, and was completed and put in service in May, 1913. Since the construction of the plant a disinfection plant has been installed in which hypochlorite of lime is used to disinfect the tank effluent.

The effluent from the disposal plant is discharged into Headson creek, which is tributary to Ley creek and Onondaga lake. The area of the watershed above the disposal plant is estimated at about two square miles. At the time of the inspection the flow in the creek amounted to about 7.15 cubic feet per second. This flow corresponds to about 5 cubic feet per second per 1,000 population contributing sewage from the village. This creek receives a greater portion of its water from seepage from the Erie canal, and during periods when the canal is not in operation and the canal is empty, the flow of the creek would probably be about one-third of the flow as observed during the inspection. No regular system of sewers or sewage disposal works discharge into the creek except at East Syracuse.

Description of sewage disposal works

Site.— The disposal plant is located in the western part of the village and south of the freight tracks of the New York Central and Hudson River railroad. It is about 400 feet from the nearest road, on which there are several houses.


EAST SYRACUSE
SEWAGE DISPOSAL PLANT
To Accompany Report of March 18, 1915
Sterilization Plant
Settling Tank
Headson Creek
0
10
20
30
Sterilization Plant
Headson Creek
Settling Tank

plant. There is also a force main 1,100 feet long leading from the pumping station to the contact beds. The approximate daily flow of sewage was estimated to amount to 33,700 gallons, this estimate being based on a determination of the amount flowing into the settling tank for a period of one hour. This amount of sewage is equal to a rate of flow per capita of 57 gallons.

The disposal plant was designed by Mr. George R. Byrne, civil engineer, of White Plains, and the plans were approved by this Department on February 28, 1907. The plant was constructed under the supervision of Mr. George R. Byrne and was placed in operation in the summer of 1908.

The effluent from the disposal works flows into the Sawmill river, which is a tributary to the Hudson river, and enters the same at Yonkers. This river has a watershed above the disposal plant of about 13⅓ square miles. The flow at the time of inspection was about 30 cubic feet per second, which is equivalent to a flow of 2.1 cubic feet per second per square mile. This amount is also equivalent to a flow of 50 cubic feet per second per 1,000 population contributing sewage from the institution. The probable minimum flow of the river would be about 2.6 cubic feet per second, or about 4.3 cubic feet per second per 1,000 population.

About 10 miles below the institution the city of Yonkers obtains part of its water supply from the Sawmill river, the water of which is filtered before being used. There are also several small institutions which discharge their sewage into the river after first passing it through the disposal plants.

Description of sewage disposal works

Site.— The settling tank and pumping station are situated immediately in the rear of the institution and on the right bank of the river. The contact beds are located up the river about 1,100 feet from the pumping station and are on the right bank of the river. There are no houses near the disposal plant and the nearest highway is about 400 feet distant.

Sedimentation tanks.— The two settling tanks are 15x12 feet in plan and have a minimum depth of about five feet. Each of the tanks therefore has a capacity of about 6,750 gallons, and with both tanks in use the theoretical detention period, with the amount of sewage flowing as found at the time of inspection, would be about 8½ hours. The tanks are constructed of mass concrete and the roof of reinforced concrete, with 6-inch "I" beams spaced three feet apart embedded in the concrete. The minimum height of sewage in the tanks is fixed by the height of the weirs, over which the sewage passes from the first tank into the second and from this tank into the pump well. If the sewage in the pump well is allowed to rise above the weirs, then the level of the sewage in the settling tanks rises at the same time. The sewage enters the first tank at about mid-depth into a small compartment two feet wide which extends the full width of the tank. In the wall are six 6x6-inch openings one foot above the bottom through which the sewage passes into the first settling tank proper. About one foot each side of the first weir and one foot in front of the weir to the pump well are spruce baffles which extend from about one foot above the surface down to about mid-depth of the sewage. Sludge is removed by allowing the sludge to flow to the pump, from whence it is pumped to a sludge bed located near the contact beds. The sludge is removed from the tank at frequent intervals. At the time of inspection the first tank was being used as a settling tank and the second tank as an auxiliary to the pump well for storage of the sewage. This operation is possible by opening the sludge valve in the bottom of the second weir.

Pumping.— The pumping plant consists of a three-cylinder pump having 8-inch plungers and a 10-inch stroke, and is operated at a rate so as to give 36 strokes per minute. The pump is driven by a 20 horse-power gasoline engine. There is also a 3-inch discharge centrifugal pump which is operated by an 18 horse-power gasoline engine. A pump well 24 feet in diameter receives the effluent from the second settling tank. This well has a depth of 5 feet 2 inches below the top of the weir from the second settling tank and a depth of 7 feet before the sewage would start to back up in the inlet sewer. A frame building 10x20 feet is located over the pump well and contains the pumping machinery. A gauge in the pump room indicated the height of sewage in the

Considering next the water of the stream above the disposal plant, the test showed 5.8 parts of oxygen consumed which indicated a small amount of pollution. The 5.5 parts of dissolved oxygen is equivalent to 45 per cent. of the possible saturation of water with oxygen. The 34 parts of chlorine was due chiefly to the chlorine found in the natural waters of that part of the State. The water was nonputrescible. The physical appearance of the water showed a slight amount of pollution as evidenced by the suspended matter carried along in the water, although the bed of the creek did not show growths due to pollution.

Referring finally to the water in the brook below the discharge of the effluent it will be seen that it contained 9 parts of oxygen consumed as compared with the 5.8 parts found in the creek water above. The dissolved oxygen showed a reduction of 1.2 parts due to the addition of the effluent which was devoid of oxygen. The chlorine test showed an increase of 14 parts due to the chlorine contained in the effluent. The result of the putrescibility test which gave a stability of only 3 5/6 days was due to the addition of the organic matter contained in the effluent, to the brook water which probably contained a considerable number of bacteria. This union of the brook water and effluent gave a water which was probably free of any residual sterilizing agent and in which the bacteria could multiply rapidly.

Summary and conclusions

As a result, then, of the investigation of this plant and after careful consideration of the condition of operation and of the result of analyses of samples from the various parts of the plant, the following summary and conclusions are presented:

1. The capacity of the settling tank is insufficient to give effective sedimentation of the sewage under the usual methods of operation or even if the tank was kept free of sludge, and furthermore, the existing tank has less than half the capacity called for by the permit issued by the State Department of Health.
2. The excessive quantity of scum and sludge in the tank prevented the sedimentation of any suspended matter contained in the sewage and in fact, due to a septic condition of the sludge and the scouring action of the sewage in passing through the tank, large quantities of sludge were being carried out with the effluent as evidenced by the turbidity, settling and oxygen consumed tests.
3. The application of the bleach to the tank effluent evidently causes considerable oxidation of organic matter and germicidal effect on the bacteria as shown by the oxygen consumed and putrescibility tests. This germicidal effect on the bacteria undoubtedly destroys a large per cent. of the intestinal bacteria contained in the effluent.
4. As the permit for the operation of a temporary plant has expired the continual operation of the plant is a violation of the Public Health Law and of the Village Law.

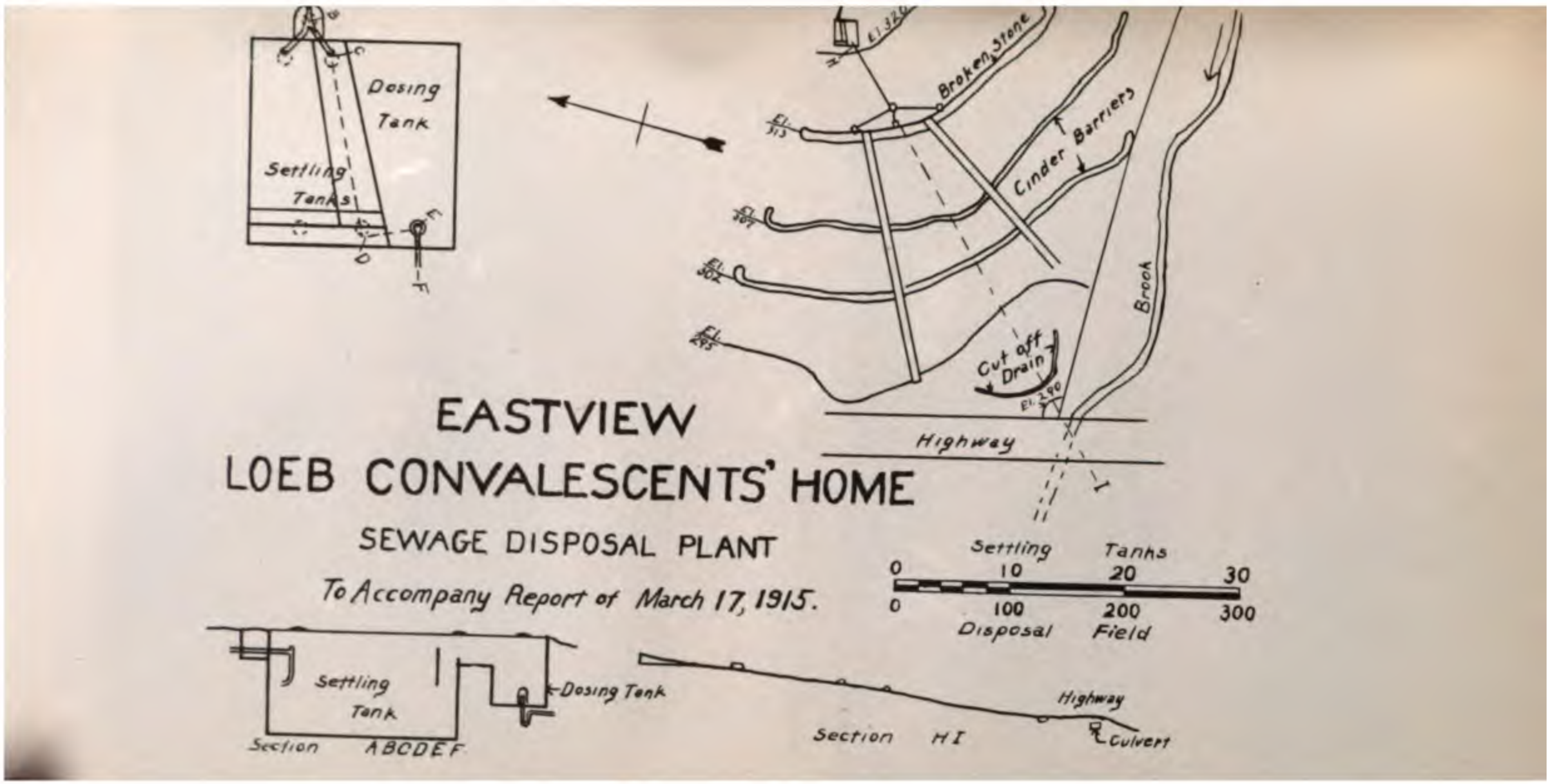
Recommendations

In view of the insufficient size and the improper operation of the existing temporary settling tank and also of the fact that the permanent plant as required in the permit issued by this Department has not been constructed, I would recommend that the village of East Syracuse be requested to proceed at once to construct the permanent sewage disposal plant as approved by this Department on February 18, 1909, and that provision be made for the removal and disposal of sludge from the settling tank.

I would also recommend that until the permanent plant is in operation, that the present plant be placed and maintained in an effective operating condition.

Respectfully submitted,
THEODORE HORTON,
Chief Engineer

ALBANY, N. Y., *March* 18, 1915


EASTVIEW
LOEB CONVALESCENTS' HOME
SEWAGE DISPOSAL PLANT
To Accompany Report of March 17, 1915.
Dosing Tank
Settling Tanks
Broken Stone
Cinder Barriers
Brook
Cut off Drain
Highway
Settling Tanks
0 10 20 30
0 100 200 300
Disposal Field
Settling Tank
Dosing Tank
Section ABCDEF
Section HI
Highway
Culvert

prevent proper sedimentation of suspended matter contained in the raw sewage.

2. The sewage was being discharged continuously from the tanks, as the siphons were not in an operating condition.

3. The disposal field was not properly caring for the sewage, and on account of the steep slope it is doubtful if it could be placed in an effective condition.

Recommendations

In view of the results of this investigation, and inasmuch as the water of the river into which the effluent is discharged is used for public water supply, I would recommend that the authorities of the Loeb Convalescent Home be requested to make the following changes in the construction and operation of the plant in order that a more satisfactory, stable and safe effluent may be obtained:

1. That a sludge bed of sufficient size be constructed.

2. That the settling tanks be cleaned out and that not more than one-third of the capacity of the tanks at any time be occupied with sludge and scum.

3. That a suitable final treatment plant such as sand filters and sterilization be installed as soon as possible, the plans for the same to be first submitted to this Department, as required by the Public Health Law.

Respectfully submitted,

THEODORE HORTON,
Chief Engineer

ALBANY, N. Y., *March* 17, 1915

EASTVIEW (Westchester County Almshouse)

HERMANN M. BIGGS, M.D., *State Commissioner of Health:*

I beg to submit the following report on an investigation of the sewage disposal plant of the Westchester County Almshouse at Eastview, Westchester county, made on December 16, 1914. This investigation was made by Mr. Morton F. Sanborn, assistant engineer, in connection with the general investigation now being carried on of sewage disposal plants in the State. A previous investigation was made of the disposal plant in 1907, the report of which is published on page 763 of the 28th Annual Report of the State Department of Health:

Location and general description

Location.—At Eastview, on the Sawmill river, on the New York Central and Hudson River railroad, Putnam division

Population.— 568 inmates and 26 employes at time of inspection

Water supply.— From the municipal supply of the village of Tarrytown

Sewer system.— 800 feet of 8-inch pipe and 1,100 feet of 6-inch cast iron force main

Sewage disposal works.— Two settling tanks, pumping station and four contact beds

The Westchester County Almshouse is a county institution for the poor who are dependent upon the county. Adjacent to the almshouse and on the same property is the county hospital. The total population at the institution at the time of inspection was 594. As the inspection was made in the winter, the number of inmates was much greater than it would have been during the summer. The water supply for the institution is obtained chiefly from the municipal supply of the village of Tarrytown, although there are two private springs which are generally used part of the winter.

The sewer system consists of about 800 feet of 8-inch sewer, which connects with the buildings of the institution and conveys the sewage to the disposal

While the results of but one set of analyses may not represent average results of operation of the plant over a long time, they do nevertheless show clearly the condition of the operation and the efficiency of the plant at the time of inspection, which may be stated as follows:

The raw sewage as received at the plant at 10 a. m. was about two-thirds of the strength of the average day flow of domestic sewage from a small municipality. This strength is shown by the settling turbidity, oxygen consumed and chlorine tests. The three parts of dissolved oxygen indicated the fresh character of the sewage. The stability of two days shown by the putrescibility test was due to the cold weather prevailing during the inspection.

The test of the tank effluent showed a considerable increase in the strength of the sewage as determined by the turbidity, oxygen consumed and chlorine. This large increase was due chiefly to the fact that the effluent was a composite sample of the sewage received from 7 a. m. to 11 a. m. and to the breaking up of the larger suspended matter by the pumps. The settling test showed a reduction of 80 per cent. of readily settling matter from the 0.5 cubic centimeters in the raw sewage to the 0.1 c. c. contained in the effluent. The 1.8 parts of dissolved oxygen, although less than that in the raw sewage, indicated that the sewage while standing in the pump well did not undergo putrefactive action. The putrescibility test gave a stability of 2½ days, which was also largely due to the cold weather.

Considering next the effluent from the contact beds, it will be seen that the effluent contained 50 parts of oxygen consumed, as compared with the 98 parts in the tank effluent. This reduction corresponds to a removal of 49 per cent. of organic matter contained in the tank effluent. The reduction from 200 parts to 70 parts of turbidity represents a clarification of 65 per cent. caused by the straining action performed by the beds. The 1.0 part of dissolved oxygen indicated a further reduction of oxygen, although the sewage received some aeration as it fell to the surface of the beds. The 0.2 parts of nitrates was possibly due to the small amount of nitrification given by the dissolved oxygen contained in the sewage rather than to any nitrification performed by the beds. The chlorine test indicated about the same original strength as that of the tank effluent. The putrescibility test gave a stability of 22 hours and indicated a greater avidity for oxygen than either the raw sewage or the tank effluent and also showed the unstable character of the effluent as discharged into the river.

The river water above the discharge of the effluent had 5.7 parts of oxygen consumed, which indicated a slight amount of pollution. The 17 parts of chlorine also indicated a small amount of pollution. The river water had 6.5 parts of dissolved oxygen and the sample tested was nonputrescible. The river water was clear and no evidence of pollution could be seen by growths on the bed of the river.

The river water below the discharge of the effluent had 6.2 parts of oxygen consumed, showing an increase of 0.5 parts due to the discharge of the effluent. The chlorine test also indicated the presence of the effluent by an increase of one part. Due to the large amount of water flowing in the river at the time of the inspection, the dilution was sufficient to give stable conditions to the river water. Also due to the large amount of water flowing, to the ice formed on the river and to the rapidity of the flow, no physical evidence of the pollution could be seen in the river water or by growths on the bed of the river.

Summary and conclusions

As a result, then, of the investigation of this plant, and after careful consideration of the condition of operation and the result of analyses of samples from the various parts of the plant, the following summary and conclusions are presented:

1. The original plans as approved on June 20, 1906, were intended to provide treatment for sewage from 330 persons amounting to 10,000 or 15,000 gallons, whereas the plant is now receiving sewage from 594 persons.

2. The gravel filter as shown by the original plans was to have a total

area of 0.22 acres and was to have a total depth of 4½ feet composed of a 1-foot layer of 1½-inch gravel, on top of which was to be placed 3½ feet of one-half to one-inch gravel, whereas the filter beds as constructed have a combined area of 0.15 acres and a depth of three feet of gravel ranging in size from 1½ to 3 inches.

3. Although the settling tanks are of ample capacity, their method of operation, involving the use of one of these tanks as a storage tank, is improper and lessens their effectiveness and efficiency of sedimentation.

4. The so-called contact beds are not constructed or operated as contact beds, and are therefore not performing the functions of contact beds, although the application of sewage to these beds is much greater than it should be unless the beds were properly constructed and operated as contact beds.

5. The plant is not operated and the effluent from the settling tank is not pumped to the filter beds throughout the period of flow of sewage from the institution. This condition is made possible by the use of one settling tank as a storage tank, whereas the original design provided for the use of one of the tanks for a storage tank for a limited period only, or until the contribution of sewage should require the use of both tanks as settling tanks, which time has now been reached. As a result of this manner of operating the plant the filter beds are considerably overtaxed during the time when the effluent is discharged on to these beds, and it is evident that the pumping should extend over a longer period during the maximum flow of sewage from the institution.

6. The subsurface tiling into which it was intended the effluent from the filter beds should discharge, as shown by the original plans, has not been constructed.

7. As a result of these defects in construction and improper operation an unstable and unsatisfactory effluent is produced, thereby seriously contaminating the Sawmill river and menacing the health of the residents of Yonkers, who use this river for a source of public water supply.

8. The plant is not constructed and operated in accordance with plans approved by this Department and the discharge of effluent therefrom is in violation of the Public Health Law.

It is evident from the foregoing that there are certain changes in the present condition and operation of this plant which are essential to provide satisfactory treatment of the sewage. There are several courses which might be taken in reconstructing or extending the plant to provide for proper treatment of sewage, among which may be mentioned the construction of subsurface irrigation system as shown by the original plans, but extended to care for the greater amount of effluent from the filter bed; the remodeling of the present filter beds in such a manner that they may be operated as contact beds, in which case it would probably be necessary that sterilization of the effluent be provided for; the substitution of sand filters for the present filter beds, in which case sterilization of the effluent would probably not be required.

Recommendations

In view of the detailed study of conditions which will be necessary before the most economical and effective design for remodeling the plant could be decided upon and in order that the plant may be remodeled and extended along proper lines to effectively care for the greater amount of sewage now contributed to it, I beg to recommend that the supervisors of Westchester county be requested to engage the services of a sanitary engineer to prepare plans for remodeling and extending the plant, which plans should provide for the following:

1. The use of both settling tanks as such and not as auxiliary pump wells.

2. A change in the method and period of operating the pump to provide for more uniform distribution of the daily flow of effluent from the tanks to the filter beds or final treatment works.

3. The reconstruction or remodeling of the final treatment works along the lines suggested above in order to provide at all times for effective treatment of the sewage.

Respectfully submitted,
THEODORE HORTON,
Chief Engineer

ALBANY, N. Y., *March* 13, 1915

FRANKLINVILLE

HERMANN M. BIGGS, M.D., *State Commissioner of Health:*

I beg to submit the following report on an investigation of the sewage disposal plant of the village of Franklinville, Cattaraugus county, made on November 11 and 12, 1914. This investigation was made by Mr. Morton F. Sanborn, assistant engineer, in connection with the general investigation of sewage disposal plants in the State now being carried on and with reference more especially to complaints received from inhabitants of the village of Cadiz regarding a condition of nuisance caused by the inefficient operation of the disposal plant:

Location and general description

Location.— Situated 18 miles north of the city of Olean, on Ischua creek, on the Buffalo division of the Pennsylvania railroad

Population.— 2,050 in May, 1914

Water supply.— Municipal from springs and wells

Sewer system.— Seven miles of sanitary sewers 6 to 15 inches in size

Sewage disposal works.— One circular horizontal flow Imhoff tank, broad irrigation field and sludge bed.

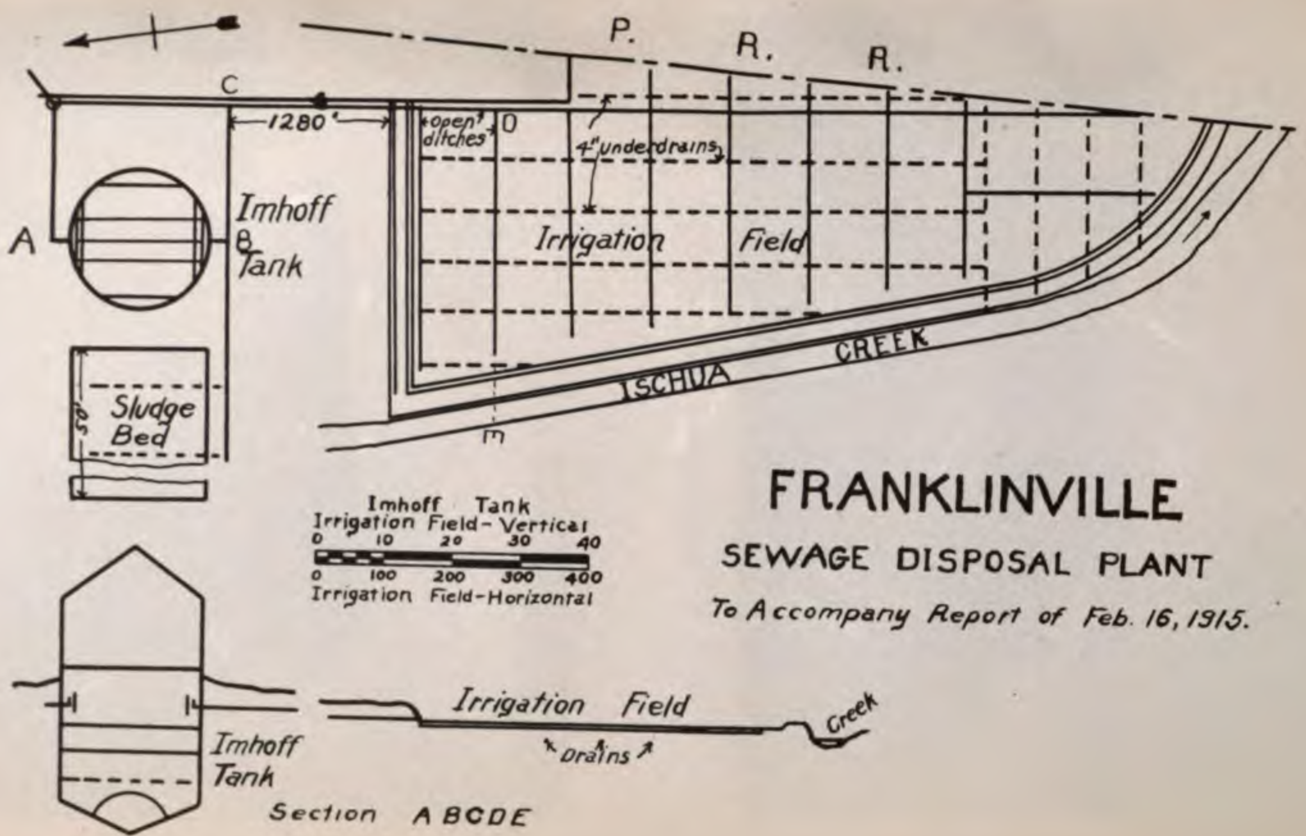
Franklinville is an incorporated village and is principally a manufacturing community. There has been a steady increase in the number of inhabitants, as in 1905 there was a population of 1,485, in 1910 the population was 1,568, and in May, 1914, the number had increased to 2,054.

The public water supply is obtained from springs and wells and the water is used without filtration. The water from the springs flows by gravity and the well water is pumped to the distributing mains. About 1,233 people, representing 60 per cent. of the inhabitants, are served by this supply. A considerable proportion of the water is used at the factories in the village.

The sewer system consists of about seven miles of sanitary sewers varying in size from 6 to 15 inches. About half of the population are served by the sewers and sewage disposal works. The approximate daily flow of sewage was about 274,000 gallons as measured with current meter at the effluent pipe from Imhoff tank. This quantity of sewage is equivalent to a per capita flow of 267 gallons, of which about 6 per cent. is estimated as trade waste and 56 per cent. is estimated as ground water.

The sewer system and sewage disposal works were designed by Charles C. Hopkins, civil engineer, of Rochester, and the plans were approved by this Department on June 13, 1911. The plant was constructed by John D. Kuhn of Greenburg under the direction of Mr. Hopkins and was completed and placed in operation in the fall of 1912.

The effluent from the disposal plant is discharged into Ischua creek, which is a tributary of the Allegany river. This creek has a watershed of about 58 square miles above the disposal works. At the time of inspection the flow in the creek amounted to about 120 cubic feet per second, or 2 cubic feet per second per square mile. The flow at that time was therefore equivalent to 117 cubic feet per second per 1,000 population contributing sewage. The probable minimum flow would be about 12 cubic feet per second, or 0.2 feet per second per square mile, amounting to less than 12 cubic feet per 1,000 population contributing sewage. The creek water is not used for a public water supply above or below the discharge of the effluent and there is no other regular system of sewers discharging into the creek.


P.
R.
R.
C
1280'
open ditches
D
4" underdrains
A
B
Imhoff Tank
Irrigation Field
ISCHUA CREEK
E
Sludge Bed
50'
Imhoff Tank
Irrigation Field - Vertical
0 10 20 30 40
0 100 200 300 400
Irrigation Field - Horizontal
FRANKLINVILLE
SEWAGE DISPOSAL PLANT
To Accompany Report of Feb. 16, 1915.
Irrigation Field
Creek
Drains
Imhoff Tank
Section ABCDE

The raw sewage enters the tank over the inlet weir, is given a downward flow by the baffle, then passes across the tank up under the scum board and over the effluent weir to the effluent pipe. In the passage of the sewage through the tank the readily settling matter is supposed to settle to the bottom of chamber and thence through the 4-inch slots to the sludge compartment. Here the sludge is allowed to stand until thoroughly changed by bacterial action from a putrifying sludge to a more or less odorless sludge. It is intended that a portion of the sludge in the tank shall be removed at frequent intervals to give room for the fresh sludge which is continually settling.

At the time of the inspection the settling compartment and the exposed portion of the sludge compartments were apparently completely filled with scum and sludge, except for a channel through the scum in the settling compartment maintained by the flowing sewage. Last spring the sludge was removed from the sludge compartment, but no attempt was made to remove any of the scum.

Irrigation field.— The irrigation field has a maximum length of about 1,050 feet, a maximum width of about 400 feet, and has an area of about 9 acres. The filtering material consists of a top soil of a mixture of loam, clay and fine sand, which at the brook was about two feet thick and apparently is nearly impervious to the passage of water. This impervious character of the soil was plainly shown on the adjacent cultivated fields, on which some rain had recently fallen. Sand and gravel were found under this top soil. About 200 feet of the embankment and part of the disposal field near the upper end had been washed away by the water in the creek. A timber bulkhead has been built on the line of the embankment and partially fills the gap made by the water. This break in the embankment allows the sewage flowing over the field to pass through the break to the creek.

With the amount of sewage flowing at the time of inspection of approximately 270,000 gallons daily, the rate of treatment if distributed over the nine acres would give a rate of about 30,000 gallons per acre per day and is about twice that usually obtained on broad irrigation fields. Inasmuch as the top soil as found here is of rather poor quality for filtration purposes, the rate of treatment is probably two or three times too great for efficient filtration. The rates of treatment are also calculated on the number of population per acre contributing sewage, and with the present population served the rate is equivalent to 112 persons per acre, and for the entire population the rate of treatment would be 334 persons per acre. With good conditions of soil the average population is about 100 contributing per acre, and for the poor soil found here it is evident that the rate is too high, especially with the creamery wastes present and as the number of persons contributing is steadily increasing.

At the time of the inspection, however, only about two acres were being used, and from observation of the flow of sewage over the ground it would appear that about 60 per cent. of the sewage flowed over the ground and passed through the break in the embankment to the creek. Of the remaining 10 per cent. of sewage part reached the underdrain through holes in the ground and part by filtration through the soil.

The main ditch had become filled with earth, causing the sewage to be discharged on the upper part of the field. Sewage covered most of the ground of the two acres in use. Apparently no attempt has been made to cultivate the fields and the continued flooding of the ground will in a short time completely fill any porous spaces and cause the ground to become sour. During the hot summer weather the field if in this condition must necessarily give off considerable offensive odors and cause a nuisance.

It is evident that the present method of operation of the disposal field is decidedly ineffective and should be corrected either by utilizing the entire area of the present field either with or without improving the condition of the field, or removal of the top soil, or by some other method of final disposal, and the following suggestions are offered as a possible solution of the difficulty:

1. It might be possible by placing the present field in a more satisfactory condition, alternately discharging the sewage on different parts of the field, utilizing the entire area, and possibly by an occasional plowing and harrowing to satisfactorily treat the effluent from the Imhoff tank.

2. It might also be possible at a reasonable cost to remove some of the impervious top soil on parts of the field, exposing the sand and gravel subsoil and replace the removed top soil with material which can treat the sewage in larger quantities than could be successfully applied to the field in its present condition. The final surface of all portions of the field thus utilized should be not less than two feet above the water in the creek.

3. If the first and second suggestions are not found practicable, then some other method of supplemental treatment such as sand filters, contact beds or sprinkling filters should be used.

4. It is also suggested that an engineer be employed to study the situation and report to the village the most feasible method to follow.

Sludge disposal.— The sludge bed is located west of the Imhoff tank and is 19x50 feet in size. Three-inch underdrains were laid 10 feet apart leading to a 6-inch drain which discharges into the effluent pipe from the Imhoff tank. An embankment was built around the bed which is raised about a foot above the ground witn material excavated for the Imhoff tank. Sludge pumped from the bottom of the sludge compartment is discharged on to the bed. Last spring sludge was pumped from the tank and the pump was kept in operation until fresh sewage came from the tank. The sludge is supposed to be plowed into the ground on the bed.

Cost and supervision of plant.— The sewer system and disposal plant cost about $50,000. The superintendent of streets has charge of the sewers and sewage disposal works. The yearly cost of maintenance of the disposal works is about $50. This figure does not include $135, the cost of the timber bulkhead constructed to reinforce the embankment. The yearly cost of maintenance of $50 is equivalent to a cost of $.50 per million gallons treated.

Efficiency of plant as determined by chemical analyses

In order to determine the efficiency of the disposal plant to properly treat the sewage contributed to it, and also as a test of the efficiency of the different units comprising the plant, analyses were made of the sewage, of the different sewage effluents and of the water of the creek into which the effluent was discharged. These analyses included a determination of the temperature of the samples and tests of settlement, turbidity, oxygen consumed, dissolved oxygen, chlorine and putrescibility. The results are shown in the following table:

ANALYSES MADE ON NOVEMBER 11, 1914

	Temperature	Imhoff cone c. c. in 1 hour	Parts Per Million					Putrescibility, days
			Turbidity	Oxygen consumed 10 min. boiling	Dissolved Oxygen		Chlorine	
					Parts	Per cent of saturation		
Raw sewage	50°	1.1	140	90	2.6	23	32	....
Tank effluent	50°	0.3	100	48	2.6	23	28	....
Final effluent	45°	0.1	Slightly turbid	34	2.3	19	24	2½
Stream above	41°	....	Clear	5.1	8.1	63	5	....
Stream below	41°	....	Clear	5.1	7.75	60	5	Over 20

While the results of but one set of analyses may not represent average results of operation of the plant over a long time, they do nevertheless show clearly the condition of the operation and the efficiency of the plant a[t the] time of inspection, which may be stated as follows:

The raw sewage as determined by the turbidity and oxygen consumed tests was about 90 per cent. of the strength of the average daily flow of domestic sewage. Of this strength probably one-quarter to one-third was probably due to the wastes from the creamery, as the oxygen consumed of ordinary wastes varies from 300 to 2,000 parts, and considering 700 parts as an average of the creamery wastes for 4 per cent. of the daily flow of sewage, the oxygen consumed due to the creamery wastes would be about 28 parts. From the settling test in the Imhoff cone and the chlorine test it would appear as if the sewage were from one-third to one-half the strength of the average domestic sewage. This weak character of the sewage is probably due to the large amount of ground water entering the sewers. The creamery wastes do not materially increase the results of the chlorine and settling tests. The dissolved oxygen test shows that the sewage was in a fresh condition as it reached the disposal plant.

The Imhoff tank effluent when tested for oxygen consumed gave 48 parts, as compared with the 90 parts in the raw sewage, and indicated a reduction of about 47 per cent. of organic matter. In the turbidity test the reduction from 140 to 100 parts showed a reduction of about 29 per cent. and indicated that a large part of the remaining turbidity was due to finely divided matter which did not readily settle. The settling test showed a reduction of about 73 per cent. of readily settling matters as indicated by the reduction from 1.1 cubic centimeters in the raw sewage to .3 c. c. in the effluent. This reduction of readily settling matter is not as good as should have been obtained if the tank had been in an efficient operating condition. The 2.6 parts of dissolved oxygen was the same as that of the raw sewage and showed no loss of oxygen in the passage of the sewage through the tank. The chlorine test gave about the same results as the raw sewage, which had a strength of about 1.3 of that of the average domestic sewage.

The final effluent of the plant, taken as the effluent flowed into the creek, gave 24 parts of oxygen consumed, as compared with the 48 parts in the tank effluent. This indicated a reduction of 50 per cent. of organic matter obtained by the settling of suspended matter and also by the oxidizing effect brought about during the passage of the effluent over the surface of the ground. The effluent was slightly turbid and gave .1 c. c. of readily settling matter. The reduction of dissolved oxygen from 2.6 to 2.3 parts was probably due to the action of bacteria as the sewage passed over the ground. The chlorine test indicated about the same strength of sewage as that of the effluent of the Imhoff tank. In the putrescibility test the samples stood up only 2½ days and indicated the unstable character of the sewage as discharged to the creek.

The water in the creek above the discharge of the effluent was clear and contained 5.1 parts of oxygen consumed, 8.1 parts of dissolved oxygen and 5 parts of chlorine. The physical condition of the bed of the stream was clear and apparently free from conditions caused by any pollution of the water.

Due to the large dilution afforded at the time of the inspection of one part of sewage to about 220 parts of stream water, the tests made below the discharge of the effluent gave practically the same results as were obtained above the discharge, that is, a clear stream with low organic content. This condition was also verified by the apparently clean condition of the bed of the stream and the nonputrescibility of the water in the stream.

As a result then, of the investigation of this plant, and after careful consideration of the condition of operation and the results of analyses of samples from the various parts of the plant the following summary and conconclusions are presented:

Summary and conclusions

1. Due to the excessive quantity of scum and sludge in the settling compartment a comparatively small detention period was being obtained as the sewage passed through the tank.

2. The withdrawal of all sludge from the sludge compartment at one time interferes with the efficient operation of the compartment since considerable time must elapse before proper bacterial action is again

resumed. Furthermore, part of the sludge withdrawn must have been in a putrefactive condition.

3. The small openings in the floor make it difficult to maintain the surface of the sewage free from scum.

4. The top soil of the disposal field is apparently poorly adapted for use in the treatment of sewage on account of its impervious character.

5. That only two of the nine acres were being used since the open ditches leading to the other seven acres were filled with earth.

6. The continued flooding of any part of the field will cause the soil to become sewage sick and scum will form which will prevent the passage of sewage through the soil.

7. The part of the embankment washed away by the stream allows the sewage to flow directly to the creek and at times of high water the field would be flooded.

8. To summarize the above statements regarding the conditions of the disposal field it may be said that the apparent impervious character of the soil, the use of only two acres of the field, the continued flooding of the portion of the field in use, the clogged condition of the ditches and the break in the embankment all contribute to an ineffectual operation of the broad irrigation field.

Recommendations

In view of the results of this investigation, I would recommend that the village of Franklinville be requested to make the following changes in the operation of the Imhoff tank and that suitable changes be made at the disposal field in order that the unsatisfactory conditions existing there may be remedied:

1. That all scum be removed from the settling and sludge compartments and that any scum forming be removed at frequent intervals.

2. That not more than one-half of the sludge in the sludge compartment be removed at a time, since the retention in this compartment of the fresher portion of the sludge is necessary for the efficient operation of the compartment and the proper reduction of the sludge.

3. That steps be taken to provide for efficient final treatment of the sewage by one of the following methods —

1. By placing the entire area of the present broad irrigation field in a proper operating condition, by applying the sewage at all times to at least seven of the nine acres and by cutting out the use of one or two acres each week, to allow the area to dry and aerate. Also by harrowing the dry portions occasionally to break up any scum that might form on the surface.

2. In the event of the broad irrigation field not being able to properly treat the applied sewage, that improvements in the existing field be made or some other method of final treatment be provided for as follows:

(a) By removing some of the impervious top soil on parts of the field, exposing the sand and gravel subsoil and replacing the removed top soil with material of a more porous nature similar to that described in the designing engineer's report as the soil of which the field was composed and under which understanding the plans were approved by this Department.

(b) By substituting for the present broad irrigation field some other type of final treatment works such as a suitable sand filter or a coarse grained filter.

4. That expert advice be obtained as to the most practicable method of carrying out the above recommendations to provide for proper operation of the plant.

Respectfully submitted,

THEODORE HORTON,
Chief Engineer

ALBANY, N. Y., *February* 16, 1915

FULTON

HERMANN M. BIGGS, M.D., *State Commissioner of Health:*

I beg to submit the following report on an investigation of the sewage disposal plant for the portion of the city of Fulton, Oswego county, lying on the west side of Oswego river. This investigation was made on December 9, 1914, by Mr. Morton F. Sanborn, assistant engineer, in connection with the general investigation of sewage disposal plants in the State now being carried on.

Location and general description

Location.— Situated about 11 miles from Lake Ontario, on the Oswego river; on the D., L. & W. R. R. and the N. Y., O. & W. R. R., and the electric line from Syracuse to Oswego

Population.— 12,000 as estimated at time of inspection

Water supply.— Municipal supply, from springs

Sewer system.— 22 miles, of which 7 miles are on the west side

Sewage disposal plant.— Five settling tanks and two dosing tanks

Fulton is principally a manufacturing community and considerable water power is developed along the river. There has been a rapid increase in the number of inhabitants in recent years, since in 1905 there was a population of 8,847 while in 1910 it had increased to 10,480 and at the time of inspection the population was estimated at 12,000.

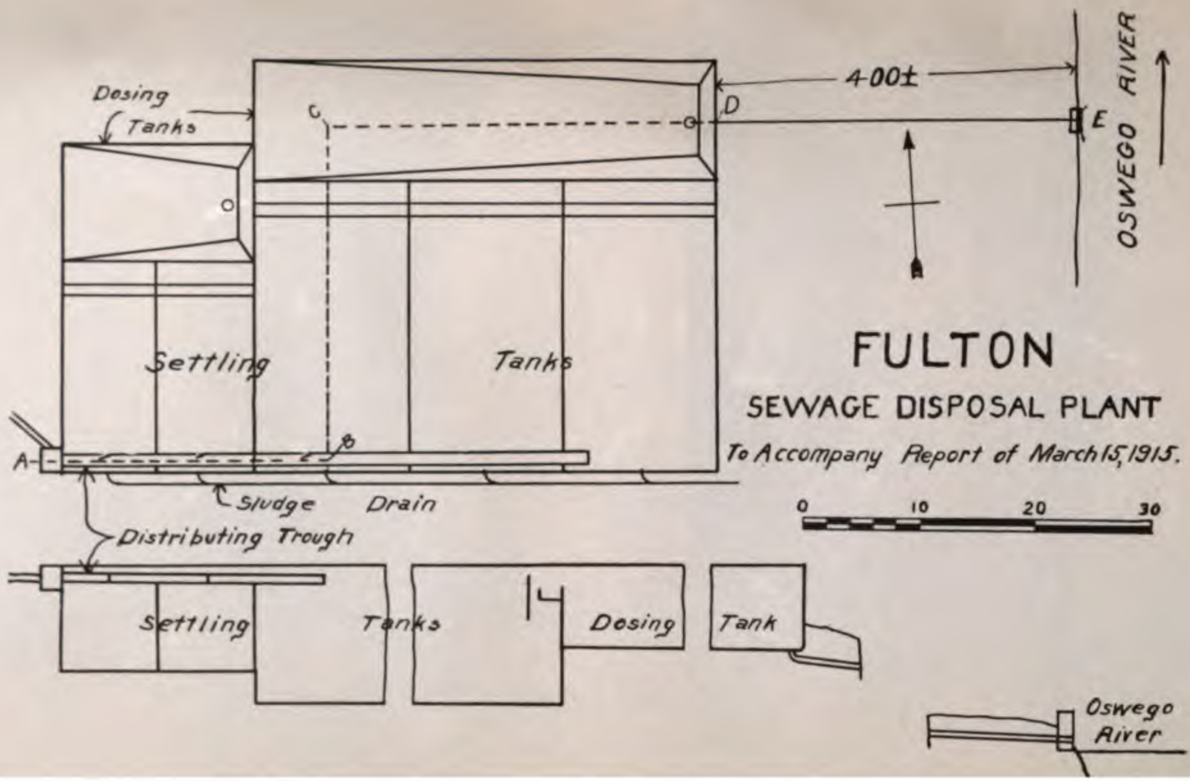
The public water supply is obtained from springs located on the east side of Oswego river and about two miles south of the city. The water is pumped to the mains and standpipe and is used without filtration. About 11,400 of the inhabitants, representing 95 per cent of the population are served by the public water supply. The daily water consumption is about 1,029,000 gallons and corresponds to a per capita consumption of about ninety gallons.

The sewer system of the city consists of 15 miles of sewers on the east side varying in size from 8 inches to 24 inches, while on the west side there are about 7 miles of sewers varying from 8 to 18 inches. All sewage from the east side of the river is discharged through a submerged outlet into the river about three-quarters of a mile below the State dam. The sewage on the west side passes through the disposal plant before being discharged into the river. About 9,600 of the inhabitants representing about 80 per cent of the total population are served by the city sewer system and of those served about 2,765 or 14 per cent of the total population are served by the sewers on the west side which are tributary to the disposal plant.

The approximate amount of sewage passing through the disposal plant as found at the time of inspection was about 307,800 gallons daily. This amount of flow was determined by current meter measurements in the flume at the plant and corresponds to a per capita daily flow of about 110 gallons. The sewage probably contains only a small amount of ground water and the sewers receive no trade wastes.

The sewage disposal plant was designed by the city engineer and plans for the same were approved as follows: On August 25, 1904, plans for a sewer system and disposal works were approved by this Department and the sewers were constructed while the disposal plant was not then constructed. On December 23, 1908, plans for settling tanks and sludge bed were approved by this Department and a temporary permit issued which limited the plant to serve a population of not over 500 people. These tanks were built in the year 1909. On November 11, 1910, plans were approved for additional settling tanks and they were constructed the following year. The construction work was all carried on by the city under the direction of the city engineer.

The effluent from the disposal plant is discharged into Oswego river which flows into Lake Ontario. This river has a watershed of about 5,016 square miles above the disposal plant. At the time of inspection about 3,500 cu. ft. per second was flowing in the river, which is equivalent to .7 cu. ft. per second per square mile. This amount of flow is also equal to about 1,266 cu. ft. per



FULTON

SEWAGE DISPOSAL PLANT

To Accompany Report of March 15, 1915.

tanks were last cleaned out part of the sludge was placed on the ground below the tanks and part was discharged directly into the river. The sludge bed as approved in the plans of 1908 was apparently designed to serve the small settling tanks shown on the same plan, while for the existing enlarged plant a larger sludge bed would probably be necessary.

Cost and supervision of plant.— No figures of the cost of the disposal plant could be obtained. The Superintendent of Public Works has charge of the sewers and sewage disposal works. The cost of maintenance is comparatively small since the only maintenance work carried on during the year was that necessitated by the cleaning out of the tanks.

Efficiency of plant as determined by chemical analyses

In order to determine the efficiency of the disposal plant to properly treat the sewage contributed to it and also as a test of the efficiency of the different units comprising the plant analyses were made of the sewage, tank effluent and river water. The report of these analyses, which includes the temperature of the samples, gives the results of the tests for settling, turbidity, oxygen consumed, dissolved oxygen, chlorine and putrescibility, and these results are shown in the following table:

ANALYSES MADE ON DECEMBER 9, 1914

	Temperature	Imhoff cone c. c. in 1 hour	Parts Per Million					Putrescibility, days
			Turbidity	Oxygen consumed 10 min. boiling	Dissolved oxygen		Chlorine	
					Parts	Per cent of saturation		
Raw sewage	43°	9.0	300	104	1.7	14	320	....
Tank effluent	48°	0.3	700	58	0.15	1	280	11/12
Stream above	38°	[illegible]	30	6.4	6.1	46	320	Over 20

While the results of but one set of analyses may not represent average results of operation of the plant over a long time, they do, nevertheless, show clearly the condition of the operation and the relative efficiency of the plant at the time of inspection which may be stated as follows:

The raw sewage as received at the disposal plant during the inspection was about the same strength as that of the average day flow of domestic sewage from a municipality of this size. This strength was shown by the turbidity test, the oxygen consumed test and the chlorine test. The high result in the chlorine test is partly due to the chlorine of from 130 to 170 parts which is found in the city water. The comparatively high value of 9 cubic centimeters of sludge obtained in the settling test was undoubtedly due to the fresh character of the sewage. The 1.7 parts of dissolved oxygen which is also a comparatively high value for this test plainly indicated the fresh condition of the sewage as received at the plant.

The tank effluent gave 58 parts of oxygen consumed as compared with the 104 parts in the raw sewage and the reduction represented a removal of about 44 per cent of organic matter. The settling test showed an apparent removal of 96½ per cent of readily settling matter from 9 c.c. obtained from the raw sewage to 0.3 c.c. obtained from the effluent. This decrease in settling matter

does not show the true removal of this matter since some of the original matter was broken up in the tank into finer suspended matter which did not readily settle and this is shown by the increase of turbidity from 300 parts in the raw sewage to 700 parts in the tank effluent. The 0.15 parts of dissolved oxygen indicated that the dissolved oxygen had practically disappeared as the effluent was discharged from the tank. The chlorine test indicated an original strength of about that of the raw sewage tested. In the putrescibility test a stability of 22 hours was obtained. This length of time was partly due to the cold weather prevailing on the day of inspection.

The river water above the discharge of the effluent had a turbidity of 30 parts, which was due to recent rains and to trade wastes which were discharged into the river. The 6.4 parts of oxygen consumed indicated a small amount of pollution of the river water. A saturation of about 46 per cent of dissolved oxygen was shown by the 6.1 parts. In the putrescibility test the sample stood up over 20 days showing the nonputrescibility of the river water. The chlorine test gave 320 parts and this is chiefly due to the chlorine found in the natural waters of some of the tributaries of the river. No physical evidence of pollution could be seen on the bed of the river and the rapid flow of the river water with the considerable dilution of the effluent from the plant prevents the formation of deposits on the bottom.

No samples were tested of the river water below the discharge of the effluent since the large dilution afforded would have prevented the detection of the effluent. Due to the rapid flow of the river and the great dilution the effluent soon mingled with the river water and no physical evidence of its presence could be detected beyond a point about 200 ft. down the river.

Summary and conclusions

As a result, then, of the investigation of this plant and after careful consideration of the condition of operation and the results of analyses of samples from the plant the following summary and conclusions are presented:

1. The by-passing of the settling tank and the passing of the sewage directly to the river is unnecessary and unwarranted and is a violation of the Public Health Law since the construction and use of the by-pass was not approved by this Department.
2. The porous condition of the walls of the tank allows sewage effluent to escape from the tank and flow over the ground surface, producing a decidedly insanitary condition.
3. The present method of disposing of sludge by allowing it to flow over the ground or into the river is an insanitary practice and definitely prohibited by the requirements of this Department.

Recommendations

In view of the results of this investigation I would recommend that the city of Fulton be requested to make the following changes in the construction and operation of the plant in order that a more satisfactory and suitable effluent may at all times be obtained.

1. That the by-pass leading from the sewer to the river be sealed up.
2. That steps be taken to make the walls of the tanks water-tight or to construct an impervious earth embankment around them in order that all seepage over the ground surface may be eliminated.
3. That a sludge bed of sufficient size be constructed to receive all sludge from the tanks and that in no event should any sludge be discharged into the river.

Respectfully submitted,
THEODORE HORTON,
Chief Engineer

ALBANY, N. Y., *March* 15, 1915

ITHACA

HERMANN M. BIGGS, M.D., *State Commissioner of Health:*

I beg to submit the following report on an investigation of the sewage disposal plant of the city of Ithaca, Tompkins county, made on March 25, 1915. This investigation was made by Mr. Morton F. Sanborn, assistant engineer, in connection with the general investigation of sewage disposal plants in the State now being carried on. A previous investigation was made of this disposal plant in 1907, the report of which is published on page 776 of the 28th annual report of the State Department of Health.

Location and general description

Location.— Ithaca is situated at the head or south end of Cayuga lake, near the center portion of Tompkins county and on the Lehigh Valley and D., L. & W. R. R.

Population.— The total population at the time of inspection was estimated at about 19,500

Water supply.— Municipal supply from Six Mile creek

Sewer system.— Thirty-three miles of sanitary sewers

Sewage disposal works.— Pumping station and five settling tanks.

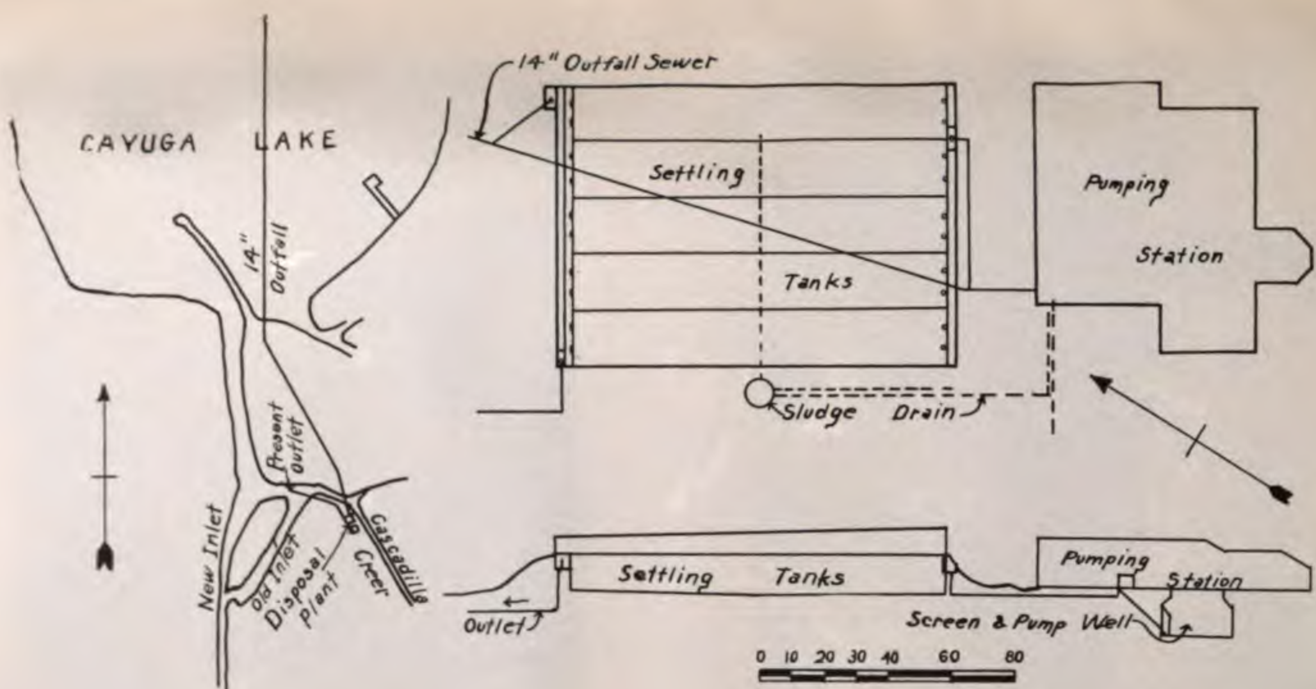
The city of Ithaca is chiefly a university city, being the home of Cornell University. There are also several industries which give occupation to many of the inhabitants. The city has had a somewhat slow but steady growth in the number of its inhabitants, since in 1905 there were 14,615, in 1910 the number had increased to 14,802, and at the time of inspection the permanent population was estimated at about 15,500. There are about 4,000 students at the university during the regular school year, while during the summer term there are about 1,000.

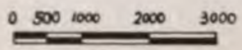
The public water supply for the city is taken from Six Mile creek and is a municipal supply. This water is filtered in mechanical filters and is pumped by hydraulic power into the reservoir and distributing mains of the city. About 90 per cent of the total population or 13,950 people are served by this supply. The daily consumption of the municipal supply is about 2,300,000 gallons. The university has a private supply which furnishes water to a small portion of the students and for the work at the different college buildings. The daily consumption of this supply is estimated at about 400,000 gallons per day. The total consumption, therefore, would be about 2,700,000 gallons per day, which is equivalent to about 154 gallons per capita per day.

The sewer system consists of about 33 miles of sanitary sewers varying in size from six inches to three feet. About 90 per cent of the population are served by the sewer system and sewage disposal plant. The flow of sewage as measured at the overflow weir at the disposal plant amounted approximately to 2,154,000 gallons per day. This sewage flow would correspond to about 140 gallons per capita per day. There is considerable ground water entering the sewers at certain times of the year, which must greatly increase the amount of sewage to be handled at the disposal plant.

The disposal plant was constructed as a result of complaints of the discharge of raw sewage into the lake. The main sewer system and pumping station were designed by Rudolph Hering and J. H. Fuertes, civil engineers of New York City and were constructed in 1895 and 1896. The disposal plant, which consists of five settling tanks, was designed by Williams and Whitman, civil engineers of New York city. The plant was constructed by P. J. Coon of Wilkes Barre, Pa., and was completed and placed in service in December, 1907.

The effluent from the disposal plant is ordinarily discharged into the inlet of Cayuga lake. This inlet has a watershed of about 170 square miles. The greatest amount of flow ever observed in the inlet was about 15,000 cubic feet per second and was the result of an extraordinarily high freshet; the high flow of the average year would probably be half of this amount. The





ITHACA

SEWAGE DISPOSAL PLANT

To Accompany Report of May 25, 1915

These pipes originally discharged the sewage about 3 feet below the surface and in a downward direction, but at the time of the inspection, practically all of the pipes were broken and the sewage flowed from the pipes in a horizontal direction. These openings are too small for all the sewage to pass through during times of the heaviest flow of sewage and as a result the sewage overflows the channel and passes out over the ground. To prevent this overflow, the valve allowing the sewage to by-pass the tank has been, at times, partially opened.

The effluent channel, at the opposite end of the tank, is five feet wide and is divided longitudinally by a partition wall into two nearly equal parts. The sewage passes from each tank into the first part of the effluent channel through two openings, 2 feet by 1 foot, which are located about 4 feet below the surface of the sewage. Concrete sludge baffles 7 feet high are placed 10 feet from both ends of the tanks. The partition walls of the tanks are constructed of reinforced concrete 1 foot thick and 14 feet high. The approved plans called for a concrete roof over the tanks, which, however, was not constructed, and a wooden roof was constructed in its place. The concrete roof would have added considerably to the strength of the side walls and, to offset the lack of this strength, 1-inch tie rods were placed every five feet between the side walls at the top to prevent the walls from spreading.

The capacity of one tank is about 147,200 gallons, while the five tanks hold about 738,000 gallons. With the amount of sewage flowing as found during the inspection, a theoretical detention period of about 7.2 hours would have been obtained with all the tanks in use. Since only a small portion of the sewage was passing through the tanks, they were of no practical value in the removal of the suspended matter. There was about 4 feet of sludge in the tanks and the sludge has never been removed from the tanks since it was not considered advisable to empty a tank with the adjacent tanks full of sewage. By lowering the level of the sewage about 3 feet in the tanks adjacent to any tank to be cleaned, the pressure on the walls would be greatly reduced and the tank might safely be emptied for cleaning of sludge. The scum has been removed at various times by flushing it out into the effluent channel and discharging it into the creek.

Final discharge of sewage.— The effluent pipe is supposed to convey the sewage to the old inlet, four or five hundred feet from the junction of the inlet and Cascadilla creek. At the time of inspection the only sewage that was observed discharging into the creek was through a break in the pipe about 30 feet from the shore at the junction of the creek and inlet. Due to changes in the inlet caused by the Barge canal, the water from the inlet passes chiefly through the new channel, which is about 1,000 feet distant from the old inlet. This produces nearly stagnant conditions in the old inlet, until it unites with the new portion, except for that flow due to the water from Cascadilla creek. Along Cascadilla creek and the lower portion of the old inlet there are many small boat houses which contain canoes, row-boats, and launches. The sewage from the pumping station may also be pumped through the old 14-inch outfall pipe leading to the lake. This pipe is not large enough to care for all of the sewage and could not be depended upon to remove all the sewage from the inlet.

Sludge disposal.— On the approved plans, provision was made for the disposal of sludge on the field west of the pumping station. This field has never been used, since the sludge has never been removed from the tanks and the scum that has been removed from the settling tank was discharged with the effluent into the creek. Screenings removed from the pump well are buried in the ground east of the station.

Operation and cost of plant.— The assistant superintendent of public works has charge of the sewers and disposal plant and the inspector of sewers has direct care of the operation of the sewers. There are employed at the pumping station three engineers and two firemen.

The settling tank cost $19,000.

Chemical analyses made to determine the character of raw sewage and of water from different parts of the inlet

In order to determine the character of the raw sewage and the waters of the inlet, analyses were made of the sewage and of the waters at various parts in the inlet. The report of these analyses, which include the temperature of the samples, gives the result of the test of settling, turbidity, oxygen consumed, dissolved oxygen, nitrates, chlorine, and putrescibility; and the results are shown in the following table:

ANALYSES MADE ON MARCH 25, 1915

	Temperature	Imhoff cone c. c. in 1 hour	Parts Per Million						Putrescibility, days
			Turbidity	Oxygen consumed, 10 min. boiling	Dissolved oxygen		Nitrates	Chlorine	
					Parts	Per cent of saturation			
Raw sewage	48°	2.5	220	32	1.5	13	....	90	1
Cascadilla creek, opposite disposal plant	....	......	....	3.5	....	......	....	4	.. ..
Old inlet, 500 feet above junction with Casadilla creek	40°	......	....	4.5	5.8	45	....	15	Over 20
Water at junction of new inlet and Cascadilla creek	40°	Trace	36	3.5	5.9	46	0.5	8	Over 20
Lake water at entrance of inlet	41°	Trace	34	3.0	5.9	47	....	7	Over 20

While these results would not represent average conditions of the discharge of sewage or effluent from the plant, especially since the settling tanks are not being used, they do, however, show the condition as found at the time of inspection and these results may be stated as follows:

The raw sewage as received at the disposal plant during the inspection was slightly less than the strength of that of the average domestic sewage of the day flow of a municipality of this size. This is shown by the tests for settling, turbidity, oxygen consumed, dissolved oxygen, chlorine, and putrescibility. The 1.5 parts of dissolved oxygen indicated that the sewage was in a fresh condition as received at the pumping station.

The sample of creek water from Cascadilla creek near the plant had 3.5 parts oxygen consumed and four parts of chlorine. This indicated only a small amount of pollution.

The water from the old inlet gave 4.5 parts of oxygen consumed and 15 parts of nitrates. These determinations indicated the presence of sewage, which would have a tendency to mingle with the practically stagnant water in the old inlet. The dissolved oxygen test gave 5.8 parts, which correspond to a 45 per cent saturation. The sample was stable as shown by the putrescibility test.

The water at the junction of the new inlet and Cascadilla creek had 3.5 parts of oxygen consumed and eight parts of chlorine. This water was probably chiefly that of Cascadilla creek combined with the sewage, and showed the great dilution of the sewage taking place at that time and also indicates the settling of suspended matter and ordinary purification brought by mingling with the large amount of fresh water. The water had 4.9 parts of dissolved oxygen, which correspond to a 46 per cent saturation. The sample also contained 0.5 of a part of nitrates, which is about what could be expected of a water of this character. The sample tested for putrescibility was also stable.

The water taken from the inlet at the entrance to the lake showed 3 parts of oxygen consumed. This shows a reduction of 0.5 of a part from that found in the water at the junction of the creek and new inlet. This reduction is probably due to a better mixing of the inlet water and sewage, which would give a greater dilution to the sewage. The dissolved oxygen test of 5.9 parts was the same as that of the water from the inlet at the junction of the creek. The chlorine of 7 parts also indicated a greater dilution than that of the sample taken at the junction of the creek and inlet. This water was also stable in the putrescibility test.

Summary and conclusions

As a result then of the investigation of this plant and after a careful consideration of the condition of operation of the plant and of the analyses of the sewage and inlet waters, the following summary and conclusions are presented:

1. Due to the valve of the by-pass being opened, nearly all of the sewage was flowing directly from the pump through the effluent pipe to the creek; and the valve could not be completely closed.
2. Owing to the small size of the inlets to the settling tanks, it is necessary, at the time of heaviest flow of sewage, to by-pass a portion of the sewage around the tank, in order that the sewage may not flow out over the ground.
3. The large amount of sludge in the settling tank would have materially reduced the detention period and would probably have reduced their efficiency as settling tanks. The scum which has been removed from the tanks has been disposed of by discharging it into the creek.
4. The break in the outlet pipe allows a greater portion or all of the sewage to enter the old inlet near the shore of the creek and this condition of discharge would naturally produce very offensive conditions in the neighborhood.
5. The present outlet of the settling tanks is in a portion of the old inlet channel, which now receives practically little or no flow except that due to the flow from the creek. The average minimum flow during the summer would probably give a dilution factor of about 0.16 cu ft. per 1,000 contributing sewage and a nuisance is sure to result from the discharge of sewage in this location.
6. The total average minimum flow in the inlets would give a dilution factor of not more than 2 cubic feet per second per 1,000 population contributing sewage, and is considered somewhat below that ordinarily allowed in order that a nuisance may not be created; and, therefore, an extension of the outlet pipe to the new inlet channel might not result in proper disposition of the tank effluent without nuisance.

Recommendations

In view of the results of this investigation, I would recommend that the city authorities be requested to make the following changes in the construction and operation of the disposal plant in order that the present plant may be maintained in a proper manner.

1. That the influent openings to the settling tanks be enlarged and that provision be made by suitable baffles to prevent a direct horizontal flow from the inlets.
2. That the valve allowing the by-passing of the sewage be repaired and that it be kept shut in order that all of the sewage may be passed through the settling tanks.
3. That the area shown on the plans for the disposal of sludge be placed in shape to receive the sludge from the settling tanks and that they be cleaned and at no time should more than one-third of their capacity be occupied with sludge and scum.
4. That at no time should any sludge or scum be discharged into the waters of the lake or streams.
5. That the break in the outlet pipe be repaired.

Furthermore, I would recommend that the city consider carefully the question of final disposal of the tank effluent in order that a condition of nuisance may be prevented in the inlet during the period of low flow of the summer and fall months, by additional purification, by discharge of tank effluent in deep water of the lake or by some other satisfactory method.

Respectfully submitted,

THEODORE HORTON,
Chief Engineer

ALBANY, N. Y., *June 3, 1915*

MT. VERNON

HERMANN M. BIGGS, M.D., *State Commissioner of Health:*

I beg to submit the following report on an investigation of the sewage disposal plant of the city of Mt. Vernon, Westchester county, made on September 22, 1914. This investigation was made by Mr. Morton F. Sanborn, assistant engineer, in connection with the general investigation of sewage disposal plants in the State now being carried on.

General description

The city of Mt. Vernon is largely a residential city and is located about thirteen miles above 42nd street, New York City. There are three railroads and several trolley lines running to or through the city from New York, which brings Mt. Vernon within an easy commuting distance of New York City. The city has had a rapid increase in population during recent years. According to the census reports there was a population of 21,228 in 1900, 25,006 in 1905; 30,919 in 1910, while the present estimated population is about 34,500.

The city is principally located on the hill forming a divide between the Bronx river and Hutchinson river and the natural drainage of the city is into these two rivers of which the Hutchinson river or Eastchester creek, receives the greater part. The highest part of the city is about 180 feet above sea level.

The public water supply is furnished by the New York Interurban Water Company and is taken from the Mamaroneck and Hutchinson rivers. The supply is filtered and pumped directly into the city mains. The average daily consumption as stated by the superintendent of the water company, is about 2,000,000 gallons, which would give a consumption of about 57 gallons per capita per day.

The sewer system consists of about 65 miles of sanitary sewer ranging in size from 8 inches to 30 inches. The city is divided into three natural drainage areas of which the greater part or about 72 per cent flows directly to the disposal plant located near Eastchester creek. About 10 per cent on the Eastchester creek watershed is at too low an elevation for the sewage to flow directly through the disposal works and therefore the sewage is received in a pump well at the works and is there pumped to the high level sewer at the entrance to the plant. As part of the city is located on the Bronx river watershed it was necessary to collect the sewage of this district and pump it over the divide and into the high level sewer leading to the disposal works. Since the construction of the Bronx Valley sewer most of this sewage is now discharged directly into this trunk sewer. About 18 per cent of the city's sewage is now flowing into the Bronx Valley sewer and there is one more connection to be made which will somewhat reduce the volume of flow in the high level sewer leading to the disposal works.

The approximate average volume of sewage flowing to the disposal works in the past was 1,500,000 gallons per day. The minimum flow was about 665,000 gallons per day, while the maximum flow was about 3,500,000 gallons and

probably included considerable ground water. These approximate volumes of flow were obtained from the records kept at the plant where an automatic gauge records the rates of flow at the weir of the screen chamber. The average daily sewage flow per capita would be about 53 gallons per day.

The disposal works are located in the southwest portion of the city on the bank of Eastchester creek. The site is apparently well selected and well elevated above the creek into which the effluent is discharged. Provision was made in the original plans for extra tanks and filters to be installed whenever required. The disposal works were designed by J. H. Farley, C. E. of White Plains, and the plans were approved by this Department on March 11, 1908. The works were constructed by Dunton & Bull of New York City, under the direction of Mr. Farley and were completed and put in service during May, 1910.

The effluent from the disposal plant flows into Eastchester creek or Hutchinson river. This creek as it flows past the disposal works is a tidal creek in which the depth of water is about 7 ft. at high tide while at low tide the creek is practically empty except for that flow due to the discharge of the effluent from the Mt. Vernon disposal works and to the effluent from the disposal works of the town of Pelham which are located about one-quarter of a mile up the creek.

Description of sewage disposal works

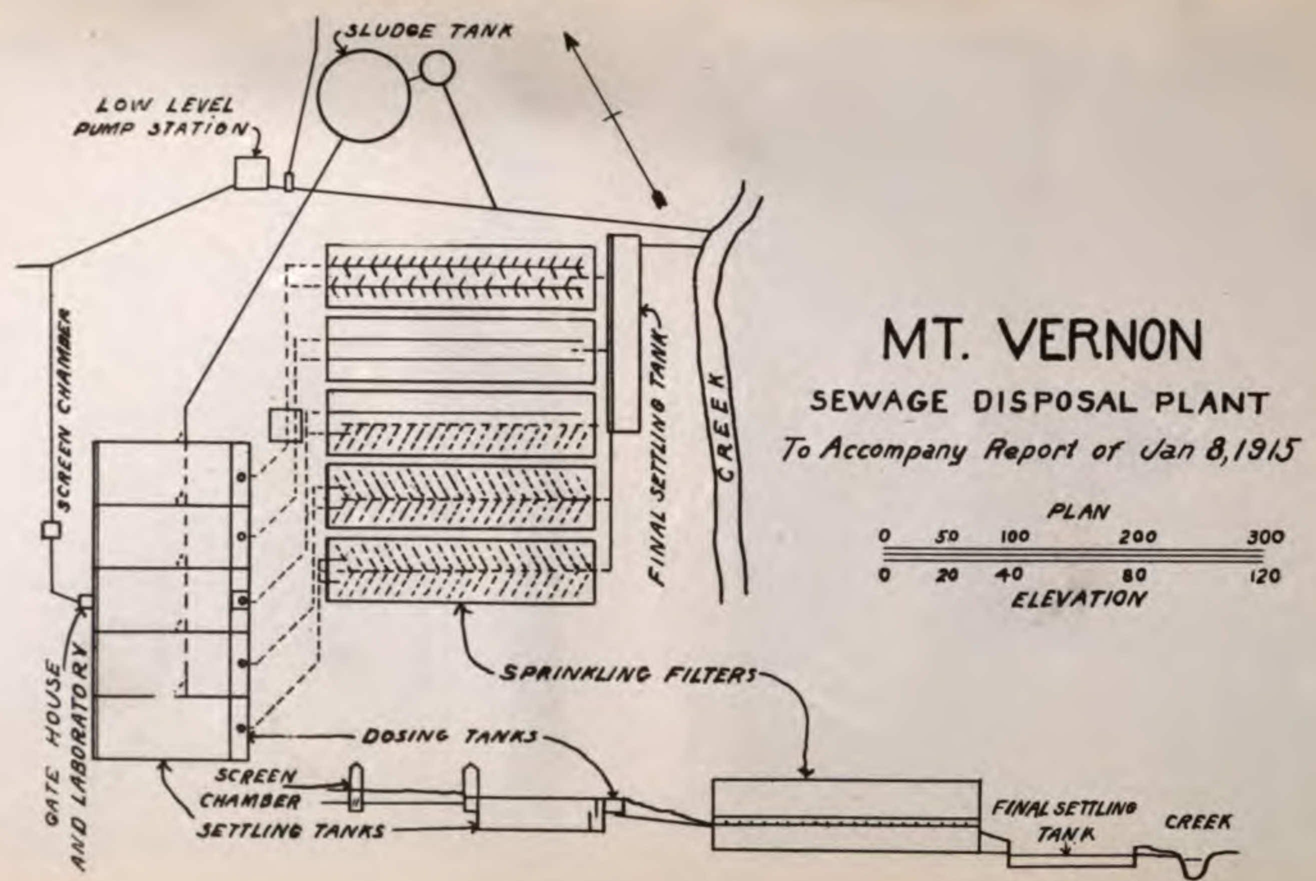
The disposal works consist of a grit and screen chamber, five settling tanks with corresponding dosing tanks, five sprinkling filters, a final settling tank and a sludge tank. There is also a small pumping station in which the sewage of the low level district is raised to the high level sewer. The works are situated on the side of a hill and arranged so that the sewage entering at the screen chamber passes by gravity through each unit of the plant and the final effluent emerges at about the elevation of high tide.

The plant is laid out in general with the different units of the same portion of the works having the same elevation and with the sewage passing from one portion of the works down to the next, as follows: The grit and screen chamber receives the raw sewage and after passing through this chamber the sewage is conveyed to a diverting and distributing chamber located at the inlet end of the five settling tanks. At the effluent end of the settling tanks are located the five dosing tanks while below these tanks are the five sprinkling filters. Between these filters and the creek is located the final settling tank. At about the same level as the sprinkling filters and north of the dosing chambers is the pumping station, while north of this station is the sludge chamber.

Pump station.— The pumping station at the disposal plant contains two submerged 6-inch centrifugal pumps which are operated automatically by electric motors. The sewage is screened before passing to the pump wells and in the screen chamber there is an overflow so that when the pumps are not in operation the sewage will overflow into the creek. When an unusually high tide occurs the water backs up into the pump well shutting down the pumps until the tide recedes.

Grit and screen chamber.—A small grit and screen chamber is provided for preliminary treatment of the sewage. Coarse and fine screening is provided, first by ½-inch bars placed so as to give openings of 1-inch and second by ½-inch bars and with ½-inch openings. These screens are inclined upward with the flow of the sewage and are cleaned with a hand rake. As only sanitary sewage is received very little grit accumulates. The combined screenings of the high level and low level sewers amount to about 11 cu. ft. per day, which is equivalent to 7.3 cu. ft. per million gallons of sewage screened. Over part of this chamber is a small house in which is located a continuous recorder that gives the depth of sewage as it passes over a weir. The screened sewage passes from this chamber to the distribution gallery or channel from which the sewage is distributed to any or all of the settling tanks.

Settling tanks.— There are five covered reinforced concrete settling tanks, 50 ft. x 100 ft. and about 8 ft. deep each holding about 300,000 gallons. The


MT. VERNON
SEWAGE DISPOSAL PLANT
To Accompany Report of Jan 8, 1915
PLAN
0 50 100 200 300
0 20 40 80 120
ELEVATION
SLUDGE TANK
LOW LEVEL PUMP STATION
SCREEN CHAMBER
FINAL SETTLING TANK
CREEK
GATE HOUSE AND LABORATORY
SPRINKLING FILTERS
DOSING TANKS
SCREEN CHAMBER
SETTLING TANKS
FINAL SETTLING TANK
CREEK

All of the filters were originally equipped with Technology dash plates but later, on the northerly bed, the dash plates were removed and square Taylor nozzles were substituted. There are two main cast-iron distributors running the entire length of the building and from these main distributors 4-inch laterals are connected with five rows of nozzles spaced 10½ feet on centers and so arranged as to form a system of equilateral triangles.

The Taylor nozzles are placed about 12 inches above the surface of the stone. The dash plates are about 20 inches above the stone and the nozzles discharging upon them have a 1-inch orifice and are about 6 feet above the stone.

The duration of the discharge through the Taylor nozzles was about nine minutes while the discharge through the Technology nozzles lasted about seventeen minutes. The period of rest for all the beds was about 12 minutes. Under conditions of average flow of sewage of 1,500,000 gallons per day and with three filters in use as at the time of inspection, the rate of filtration would be about 2,000,000 gallons per acre per day, or 286,000 gallons per acre per foot of depth per day. This is a comparatively high rate for the strong sewage received, the strength of which might be expected by the low flow per capita and as is shown by the analysis. With all the filters in use the rate of operation would be 1,250,000 gallons per acre per day.

The first three beds have been in continuous use for the last three years and the surface of these beds was covered with algae and sewage fungus growths and the sewage stood in pools in many places on the surface. The upper portion of these filters contained a great quantity of small red worms and many small moth flies (*Psychoda*) were seen flying above the filters or lodged on the wall or surface of the beds. The fourth bed, which had not been used for three or four months, presented a much better appearance and the stones were nearly dry. The fifth bed had not been used for about two years and the stones were apparently clean and dry.

Secondary sedimentation.— A secondary tank about 25 ft. x 150 ft. and 4 ft. deep was constructed so that the suspended matter contained in the sprinkling filter effluent might be disposed of other than by discharging it into the creek. This chamber was divided into four compartments by partition walls containing weirs over which the effluent passed while the sludge remained in the compartments. These partition walls were removed several years ago and any sediment that settles in the chamber at high tide is flushed out into the creek during low tide, thus canceling any benefit that might be obtained from an efficient settling tank if properly operated.

Ventilating towers.— There are two gas filtering or ventilating towers, one about 14 feet square intended to be operated in connection with the siphon chambers and the other about 25 feet square for use with the sprinkling filters. These towers are built of reinforced concrete and contain five layers of iron oxide about 3 feet thick. Through the walls of the towers above each layer of iron oxide, are several openings which give opportunity for the purified air to pass into the surrounding air. The foul air is drawn from the filters or gallery by means of air blowers driven by electricity and forced up through one of the layers of iron oxide which is supposed to remove the hydrogen sulphide. These towers have never been used except for testing purposes.

Sludge disposal.— There is a covered sludge tank 75 feet in diameter and from 10 to 14 feet deep. Underdrains were placed on the bottom of the tank and then covered with 3½ feet of filtering material consisting of broken stone 2 and 3 inches in diameter on the bottom to cinders at the surface. About 820 cubic yards of sludge are placed in the tank at a time which gives a depth of about five feet over the cinders. The sludge from the sedimentation tanks flows to the sludge tank and the clearer portion overflows a bulkhead to a pump well from which it is pumped back to another sedimentation tank. Sludge is allowed to stand draining in the sludge tank about four months after which it is carried out in wheel-barrows and dumped on the marsh.

There is a circular well or chamber 25 feet in diameter that receives the effluent of the sludge chamber and in it the effluent is supposed to be treated with bleach or other chemicals to render it inoffensive. Five or six barrels of bleach and one barrel of sulphur naphthol are used in this chamber and around the plant each year.

Cost and operation of plant.—The cost of the plant as given by the City Engineer was about $155,000. The annual operating expenses at the plant amount to about $8,000 and includes labor, power for pumping, lights and repairs. With an average daily flow of 1,500,000 gallons the cost per million gallons filtered would be about $14.60.

In the operation of the plant one foreman and three laborers are employed during the day and at night there is one laborer on each of the two night shifts. Samples of the sprinkling filter effluent are collected twice a day by the attendants and tested for putrescibility with methylene blue.

Efficiency of plant as determined by chemical analyses

In order to determine the efficiency of the disposal plant to properly treat the sewage contributed to it and also as a test of the efficiency of the different units comprising the plant, analyses were made of the sewage, and of the different sewage effluents. These analyses included the temperature of the sample and comprised tests for settling solids, turbidity, oxygen consumed, dissolved oxygen, nitrates, chlorine and putrescibility and the results are shown in the following table:

ANALYSES MADE ON SEPTEMBER 22, 1914

	Temperature	Imhoff cone c. c. in 1 hour	Parts per million						Putrescibility, days
			Turbidity	Oxygen consumed, 10 min. boiling	Dissolved oxygen		Nitrates	Chlorine	
					Parts	Per cent of saturation			
Raw sewage	69°	8.5	500	200	0	0	....	....	....
Tank effluent	68°	0.7	325	88	0	0	....	270	....
Filter effluent	70°	4.0 (½ hr.)	100	43	1.6	18	6.4	....	1½

While the results of but one set of analyses may not represent average results of operation of the plant over a long time they do, nevertheless, show clearly the condition of the operation and the efficiency of the plant at the time of inspection which may be stated as follows:

The raw sewage received at the disposal works was about twice as strong as the average daily flow of domestic sewage of a municipality of this size, as is seen by the high figures for oxygen consumed, turbidity and settling solids. The strength of this sewage can be largely accounted for by the fact that the average daily water consumption and sewage flow per capita are about one-half or even less than the corresponding figures for the average city. The absence of dissolved oxygen in the raw sewage indicated strongly that the sewage was septic at the time it reached the plant.

The effluent of the settling tank gave a good reduction of organic matter as shown by the oxygen consumed figures of 200 parts for the influent and 88 parts for the effluent resulting in a 56 per cent purification. The settling test indicated that about 82 per cent of the readily settling matter was removed, but the test showed that there still remained 0.7 c.c. of sludge which would have been removed in an effluent settling chamber. The turbidity test gave high results in both influent and effluent, a large part of which was due to finely divided matter that did not readily settle. The high figures in the settling test and turbidity of the effluent may be due partially to active septic action taking place in the tanks. The absence of dissolved oxygen is what

could be expected in view of the fact that none was present in the influent and after the long detention period given by the tanks. The high chlorine affords further evidence of the strength of the sewage.

Referring next to the sprinkling filter effluent it will be seen in the test for oxygen consumed that while there was a purification of about 49 per cent the effluent still contained 43 parts, which is high for a sprinkling filter in good condition of operation. The Imhoff cone test gave 4 c.c. of sludge, which is considerably higher than the applied sewage and may be due to the partial oxidation of the finely divided organic matter present in the sewage as well as to a partial unloading of suspended matter in the filters. This plainly shows the need of an efficient sedimentation for the effluent in order that the suspended matter may be removed from the effluent before it is discharged into the creek. The turbidity test showed a good percentage of reduction, this being represented by a decrease from 325 parts to 100 parts, but the final turbidity of 100 parts showed plainly the undesirable character of the effluent. The 1.6 parts of dissolved oxygen and the 6.4 parts of nitrates indicate a fair amount of nitrification, but the low stability as determined by the putrescibility test plainly shows the unstable character of the final effluent.

No tests were made of the water in the creek into which the effluent is discharged as the creek is a tidal body of water and at high tide there is about seven feet of water in it while at low tide the creek is nearly empty; therefore at high tide the sewage would be greatly diluted while at low tide the water in the creek would consist chiefly of the effluents from this plant and from the Pelham disposal works.

Summary and conclusions

As a result, then, of the investigation of this plant, and after careful consideration of the condition of operation and the results of analyses of samples from the various parts of the plant the following summary and conclusions are presented:

1. The grit and screening chamber is apparently maintained in good condition and its operation results in effective screening of the sewage.
2. The sedimentation tanks are operating satisfactorily and give a good percentage of clarification although not all of the readily settling solids were being removed.
3. The three sprinkling filters in use are not in a satisfactory condition and are not giving a stable effluent since they are too heavily dosed, while the pooling of sewage on the surface due to the fineness of the material in the upper part, and to the growth on the surface prevents proper aeration of the beds.
4. The secondary sedimentation tank is not working properly since the removal of the weirs interferes with proper sedimentation.
5. The gas purifier has not been in operation, but the odors have not been objectionable near the plant except at times of removing sludge.
6. The treatment and disposal of sludge from the settling tank is apparently carried on in a satisfactory way, but the disposal of the sludge from the secondary settling tank by discharging it into the creek is not in accordance with the design for the construction and operation and partially defeats the object for which the plant was constructed.
7. The overflow from the low level sewer permits the salt water at the highest tides to flow into the pump well, this causing the pumps to be shut down, which allows the raw sewage to flow directly to the creek.

Recommendations

In view of the results of this investigation, I would recommend that the city of Mt. Vernon be requested to make the following changes in the con-

struction and operation of the plant in order that a more satisfactory and stable effluent may be obtained:

1. That all of the five sprinkling filters be used continuously in order that a lesser rate of application of the strong sewage may be obtained for each bed.

2. That in case the pooling on the surface of the filters continues the upper foot of ½-inch stone be cleaned and maintained in a clean condition or the layer removed and stone of the same size as that in the body of the filter be substituted (i. e. 1 inch to 1½ inches).

3. That the secondary sedimentation tanks be properly repaired and put in use.

4. That provision be made for removing the sludge to a sludge bed or tank.

5. That the overflow from the low level sewer be provided with tide gates, stop planks or other suitable devices to prevent the sea water from backing up into the pump well.

Respectfully submitted,

THEODORE HORTON,
Chief Engineer

Albany, N. Y., *January* 8, 1915

PELHAM

Hermann M. Biggs, M.D., *State Commissioner of Health:*

I beg to submit the following report on an investigation of the sewage disposal plant of the town of Pelham, Westchester county. The plant serves also the villages of Pelham, North Pelham and Pelham Manor, which are located within the town limits. This investigation was made on September 24 and 25, 1914, by Mr. Morton F. Sanborn, assistant engineer, in connection with the general investigation of sewage disposal plants in the State now being carried on.

Location and general description

Location.— Situated north of New York City and between Mt. Vernon and New Rochelle

Eastchester creek and Hutchinson river form the east boundary

The N. Y. C. & H. R. R., the N. Y. W. & B. R. R. and several lines of electrics pass through the town

Population tributary to plant.— Estimated at 4,000 at time of inspection

Water supply.— From the New Rochelle Water Company and the New York Interurban Water Company

Sewerage system.— Twenty miles sanitary sewers, 8 inches to 20 inches

Sewage disposal works.— Screen and grit chamber, 4 settling tanks, 3 pumps, 3 dosing tanks and 3 sprinkling filter units.

The town of Pelham is largely a residential community as it is within easy commuting distance of New York City. There has been a rapid increase in the number of inhabitants of late years since in 1905 there were 1841, in 1910 the population was 2,998 and at the time of the inspection the number had increased to about 4,000.

The public water supply is obtained from various sources by private companies which supply the different villages as follows: North Pelham and Pelham Manor are supplied chiefly by the New Rochelle Water Company which obtains their supply from the Hutchinson river, Troublesome brook and driven wells at New Rochelle and Pelham and the water is treated with hypochlorite of lime. The supply for Pelham is obtained principally from the New York Interurban Water Company, which company takes water from the Mamaroneck and Hutchinson rivers and supplies it to Pelham and other municipalities after filtration. Practically all of the residences in the town are supplied with water from some public source.

The sewer system comprises about twenty miles of sanitary sewers ranging in size from 8 inches to 20 inches. The sewers in each village are under the control of the respective village authorities. The sewers in the unincorporated part of the town come under the care of the sewer commissioners of the unincorporated portion of the town of Pelham. The disposal plant is under the charge of the Pelham sewage disposal works commissioners.

Practically all of the population is served by the sewer system and disposal works. The flow of sewage as determined by measurements at the time of inspection corresponds to an average flow of 722,000 gallons per day, which is equivalent to an average flow of about 180 gallons per capita per day. This per capita flow of sewage though not excessive is somewhat above what would be expected for a community of this character and size. This higher flow is probably due to ground water leakage into the sewers and the engineer at the disposal plant stated that following rains the flow is at times increased by as much as one-third of the average flow.

The sewage disposal works were designed by H. B. Roberts, civil engineer of New York City, and Hering & Fuller, consulting engineers of New York City. The plans were approved by this Department on May 26, 1910. The plant was constructed by the Gifford Construction Company of Long Island City under the direction of H. B. Roberts, and was completed and placed in operation during February, 1912.

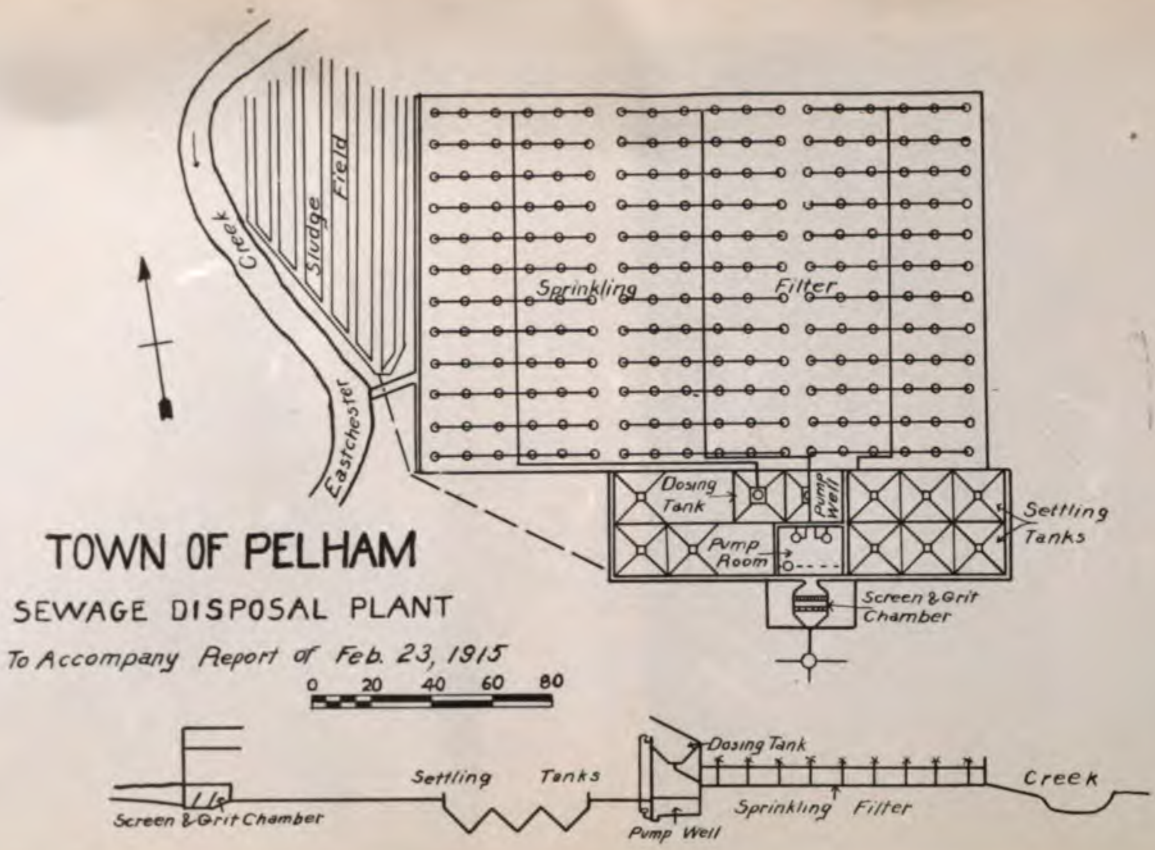
Eastchester creek or Hutchinson river receives the effluent of the sprinkling filters and at the location of the disposal plant it is a tidal creek in which the depth of water varies from practically nothing at low tide, except that due to the effluent from the Pelham and Mt. Vernon disposal plants, to about five feet at high tide. There are several impounding reservoirs located on Hutchinson river in which is retained for purposes of public water supply the greater part of the water flowing in the river, so that the flow of upland water past the disposal plant is comparatively small.

Description of sewage disposal works

Site.— The works are located on the left bank of Eastchester creek near the southwest part of the town. The sewage received at the plant is pumped in order that it may pass through the sprinkling filter. The underdrains of the filters are partially submerged during the time of extreme high water. The plant is about 600 feet from the nearest house and the neighborhood is very sparsely settled.

Grit and screen chamber.— This chamber is a combined grit and screen chamber 12 feet wide, 9 feet long and about 3½ feet deep. This chamber contains both a coarse and a fine screen which are inclined with the flow of the sewage at about an angle of 30 degrees from the vertical. The screens are about 4 feet high and extend across the entire width of the chamber. The coarse screen consists of ½-inch bars spaced to give openings of 1½ inches and the second or fine screen is of a similar character except that the openings are but ½-inch wide. On both days of the inspection and on a previous visit both screens were clogged and the sewage flowed over the screen to the settling tanks. It was stated by the attendant that the screens were raked every two days and that about 1½ wheelbarrows of screenings were removed at each cleaning. The chamber at the time of the inspection contained about 2½ feet of silt and sludge.

Sedimentation tanks.— There are four sedimentation tanks each 16 ft. wide and 48 ft. long. The sides of these tanks are vertical for 4 feet in depth below the surface of the sewage and the bottom of each tank is divided into three hopper-shaped compartments with the apex of each 11 feet below the surface. The total capacity of one tank is about 39,300 gallons. The sewage enters the tanks through two openings 2 feet wide which act as weirs, in one end of each tank and leaves by similar openings in the other end of the tanks. No scum baffles are provided in the tanks. The sludge settles in the hoppers and is removed by a pump which is located in the pumping chamber. Three 4-inch pipes for the removal of sludge are placed in each tank with the suction of a pipe near the bottom of each hopper.


TOWN OF PELHAM
SEWAGE DISPOSAL PLANT
To Accompany Report of Feb. 23, 1915
0 20 40 60 80
Creek
Sludge
Field
Eastchester
Sprinkling
Filter
Dosing Tank
Pump Well
Pump Room
Settling Tanks
Screen & Grit Chamber
Settling
Tanks
Dosing Tank
Sprinkling
Filter
Creek
Screen & Grit Chamber
Pump Well

siderable sewage to escape and flow directly to the underdrains without passing through the nozzles.

With the amount of sewage flowing at the time of inspection if distributed equally to the three units, the rate of filtration would be about 1,213,000 gallons per acre per day or 202,000 gallons per acre per foot of depth per day; but under the conditions of distribution as found during the inspection, the center unit was being treated at a rate of 1,850,000 gallons per acre per day while the other two units were being treated at a rate of about 925,000 gallons per acre per day.

Sludge disposal.— Between the sprinkling filter and the creek is a sludge disposal field about 50 ft. wide and 80 ft. long. The surface of this field is furrowed and the sludge is supposed to be placed in the furrows and later plowed into the ground. In the report of the designing engineers it was stated that the sludge would be drawn from the bottom of the settling tanks from time to time, placed on the sludge field and plowed under. This is not done under the present methods of operation since two tanks are kept in use about ten months, then allowed to stand full two or three months after which the contents are pumped out.

It was stated by the attendant that the sludge was discharged with the settled sewage and passed through the sprinkling filters. I do not understand how this improper method of sludge disposal can be used since the sludge would tend to clog up the nozzles and filter, and since the plans show the discharge pipe from the sludge pump leading to the sludge field and not to the pump wells. This sludge field is entirely too small to receive all the sludge from the tanks and it is probable that the greater part of the sludge overflows the field and reaches the brook. No sludge was noticed on the field. The attendant said that about two cubic yards of grit was removed from the tanks each year and placed on the ground in front of the filter unit nearest the creek.

Cost and maintenance of plant.— The disposal plant is under the charge of the superintendent of the Pelham sewage disposal works commissioners and he with one other man operates the plant during the twenty-four hours of each day.

The cost of the disposal plant was $65,000. The cost of maintenance amounts to about $3,800 per year of which $2,000 is for labor, $1,500 for power and $300 for repairs. This gives a total average cost per million gallons of sewage received of $14.42 of which $7.59 is for labor, $5.69 is for pumping and $1.14 is for repairs.

Efficiency of plant as determined by chemical analyses

In order to determine the efficiency of the disposal plant to properly treat the sewage contributed to it and also as a test of the efficiency of the different units comprising the plant, analyses were made of the sewage and different effluents of the plant. These analyses included the temperature of the samples and tests for settling solids, turbidity, oxygen consumed, dissolved oxygen, nitrates, chlorine and putrescibility. The results are given in the following table:

ANALYSES MADE ON SEPTEMBER 24, 1914

	Temperature	Imhoff cone c. c. in 1 hour	PARTS PER MILLION						Putrescibility, days
			Turbidity	Oxygen consumed, 10 min. boiling	DISSOLVED OXYGEN		Nitrates	Chlorine	
					Parts	Per cent of saturation			
Raw sewage	68°	3.5	180	96	0	0	....	....	....
Tank effluent	69°	0.1	140	62	0	0	....	800	....
Sprinkling filter effluent	64°	......	80	46	1.4	14	0.5	....	5/6

While the results of but one set of analyses may not represent average results of operation of the plant over a long time they do, nevertheless, show clearly the condition of the operation and the efficiency of the plant at the time of the inspection, which may be stated as follows:

The raw sewage as received at the plant at the time of inspection was of about the same strength as the average day flow of domestic sewage of a municipality of this size, as shown by the tests for settling solids, turbidity and oxygen consumed. The absence of dissolved oxygen indicates strongly that the sewage in the trunk sewer was septic at the time it reached the plant.

The effluent of the settling tank contained 0.1 cubic centimeter of sludge in the Imhoff cone test as against the 3.5 c.c. of the raw sewage and this reduction represents a removal of 97 per cent of the readily settling matter. A reduction of 35 per cent of organic matter was obtained as the sewage passed through the tank. This is shown by the reduction in the oxygen consumed test from 96 parts in the raw sewage to 62 parts in the effluent. The reduction of turbidity from 180 parts to 140 parts indicated a clarification of 22 per cent. The effluent contained no dissolved oxygen as would naturally be expected with no dissolved oxygen in the influent and representing the flow from a tank in which there was a detention period of about three hours. The test for chlorine does not give any indication of the strength of the sewage except to indicate excessive chlorine which might be caused by a large amount of sea water reaching the disposal plant or to wastes from some industry, as an ice cream plant in which considerable salt would be used in the freezing of the cream.

Considering next the effluent of the sprinkling filter it will be seen that the reduction from 62 parts in the influent to 46 parts in the effluent as determined in the oxygen consumed test indicated a purification of only 26 per cent. The reduction in turbidity from 140 parts to 80 parts represents a clarification of about 43 per cent. The 1.4 parts of dissolved oxygen is much lower than should be found in the effluent from a good sprinkling filter. The nitrate test gave only 0.5 part and indicated an effluent in which but little nitrification had taken place. The putrescibility test in which the sample stood up but five-sixths of a day plainly showed the poor character of the effluent.

No tests were made of the water in the creek into which the effluent flowed as the creek is a tidal body of water and at high tide there is about 5 feet of water in it while at low tide the creek is nearly empty; therefore, at high tide the sewage would be greatly diluted while at low tide the water in the creek would consist chiefly of the effluent from this plant and from the disposal plant of the city of Mount Vernon.

Summary and conclusions

As a result, then, of the investigation of this plant and after consideration of the condition of operation and the results of analyses of samples from the various parts of the plant the following summary and conclusions are presented:

1. That the use of the overflow allowing the raw sewage to be discharged directly into the creek is a violation of the Public Health Law and of the Town Law since the construction and use of the overflow were not approved by this Department.
2. That the pumps are at times shut down and the sewage is allowed to flow directly to the creek.
3. That the grit and screen chamber was not being properly maintained and sewage was found overflowing the screen.
4. That the siphons will not break during the operation of the pumps which results in a comparatively low head for a large part of the sewage applied to the sprinkling filters and a lack of uniformity of distribution.
5. That the discharge from the pump near the center dosing tank gave a rate of flow to the center sprinkling filter unit of about twice the rate of flow to either of the other two units.

6. That apparently the broken or open distributing system at the sprinkling filter allows considerable sewage to flow directly to the underdrains instead of through the nozzles and this may account partially for the poor purification accomplished by the sprinkling filters.

7. That the present method of sludge disposal is unsatisfactory.

Recommendations

In view of the results of this investigation, I would recommend that the Pelham Sewage Disposal Works Commissioners be requested to make the following changes in the construction and operation of the plant in order that the works may be placed in proper operating condition and that the violations of the Public Health Law and of the Town Law may be discontinued.

1. That the overflow allowing the raw sewage to pass directly to the creek be sealed up and if an overflow is needed in case the pumps are both out of order that an overflow be provided for the effluent of the settling tanks, this overflow to be used only in an emergency.

2. That the custom of shutting down the pumps and allowing the sewage to flow to the creek without passing through the entire plant be discontinued.

3. That the grit and screen chamber be cleaned out and maintained in an efficient condition.

4. That but one pump be used at a time and an overflow from one pump well to the other be provided so that in case of the pump breaking down or not being able to handle the sewage received the other pump will automatically start when the well is filled.

5. That the opening to the middle dosing tank be reduced in area or other arrangements made in order that the middle sprinkling filter will receive only its proportional amount of the effluent from the settling tanks.

6. That the siphons be adjusted so that they will break while one pump is in operation.

7. That any leaks or openings in the distributing system at the sprinkling filter be closed, except possibly one small opening in each unit during the winter to allow the sewage standing in the system during the interval between discharges to drain.

8. That the sludge field be made over into a sludge bed of proper size and underdrained since under the present methods of operation the present field will not properly care for the sludge.

Respectfully submitted,

THEODORE HORTON,
Chief Engineer

ALBANY, N. Y., *February* 23, 1915

PENN YAN

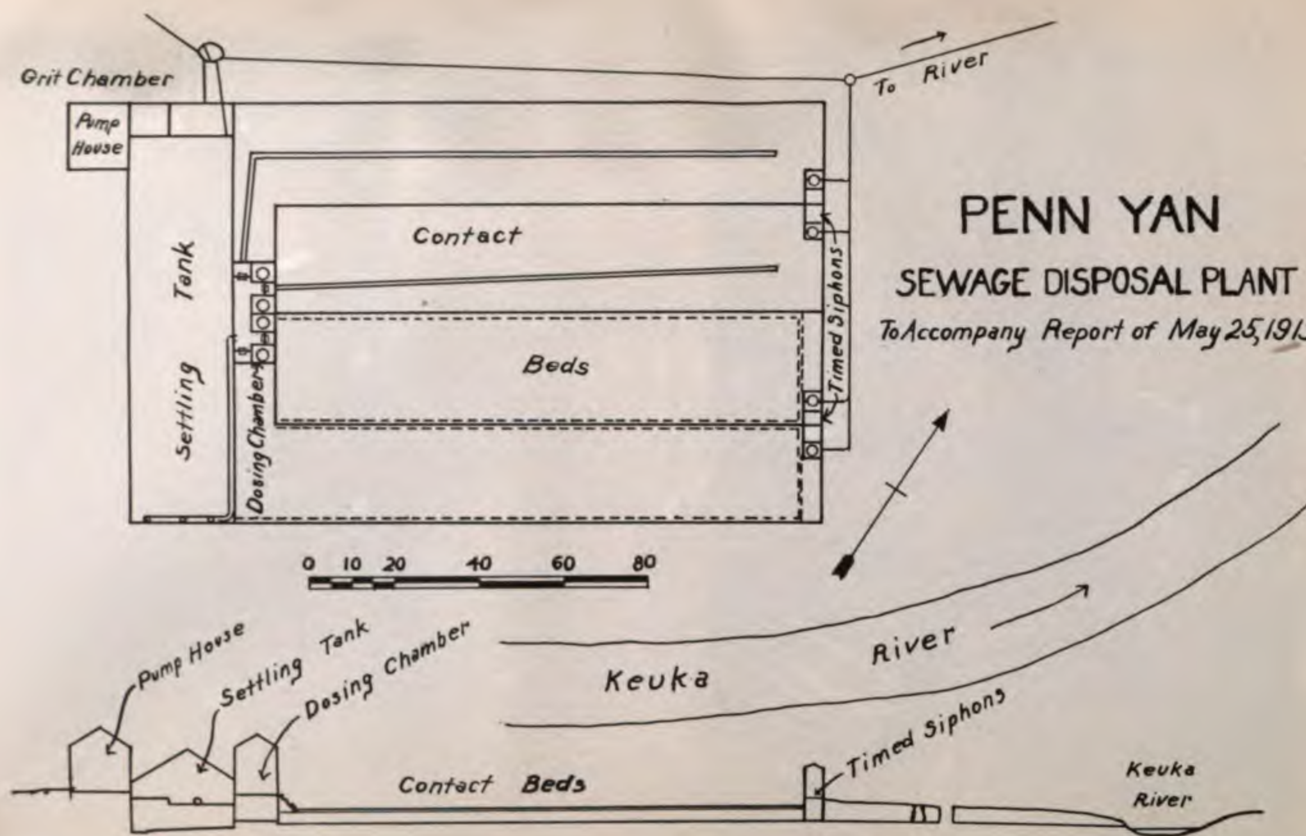
HERMANN M. BIGGS, M.D., *State Commissioner of Health:*

I beg to submit the following report on an investigation of the sewage disposal plant of the village of Penn Yan, Yates county, made on March 23, 24, 1915. This investigation was made by Mr. Morton F. Sanborn, assistant engineer, in connection with the general investigation now being carried on of the sewage disposal plants in the State. A previous investigation was made of this disposal plant in 1907, the report of which is published on page 804 of the 28th annual report of the State Department of Health.

PENN YAN

SEWAGE DISPOSAL PLANT

To Accompany Report of May 25, 1915.



as a source of public water supply before the stream discharges into Seneca lake, but the city of Geneva obtains its water supply from Seneca lake about ten miles from the entrance of Keuka river.

Description of sewage disposal works

The sewage disposal plant consists of a grit chamber, a settling tank, and a pump well which were constructed as one unit and are under the same roof, a dosing chamber, four contact beds, and four timed siphons. A pumping chamber is also provided for the removal of the sludge.

Site.— This disposal plant is located east of and just outside of the village limits on the north bank of Keuka river. It is also situated immediately south of the Penn Yan branch of the N. Y. C. & H. R. R. The nearest houses to the plant are about 400 feet distant.

Grit chamber.— The grit chamber is constructed of concrete and is 6 feet by 12½ feet in plan and about 6 feet deep. About mid-depth in the northern wall of the chamber is located the effluent pipe which is 10 inches in diameter. This pipe leads from an overflow manhole located about 20 feet outside of the chamber. The south wall of this chamber acts as an effluent weir over which the sewage flows into the settling tank. The capacity of the grit chamber is about 3,375 gallons and, with the amount of sewage flowing as found at the time of inspection, it would give a theoretical detention period of 6½ minutes. The chamber, however, was practically filled with sludge and scum so that comparatively little or no detention period was available.

Settling tank.— The settling tank is constructed of concrete and is 88 by 22 feet in plan and has an average depth of about 6 feet. The tank has a capacity of about 88,700 gallons and, with the amount of sewage flowing as found at the time of inspection, a theoretical detention of about 2¾ hours would be obtained.

The effluent enters the tank over the weir of the grit chamber as stated above. A 12-inch collector and effluent pipe extends across the opposite end of the tank and along the east side to the receiving basin at the dosing chamber. In this pipe at the end of the tank, there is a standard bend and two "T's" all of which are turned down and their open ends are about 3½ feet above the bottom of the tank. The floor of this tank slopes slightly toward the west side along which runs the sludge channel, 4 feet wide, which leads to the pump well. A 12-inch pipe with valve extends from the inlet end of the settling tank to the by-pass or overflow manhole. This valve was found partially open and it was estimated that about one-third of the sewage passed through the grit chamber, entered the settling tank, and then flowed immediately back to the by-pass and thence to the river. The valve was closed by the Superintendent and, for the rest of the day, the sewage all passed through the disposal plant. At the time of the inspection it was estimated that about one-third of the capacity of the tank was occupied with sludge or scum. The tank was last cleaned out about one year previous to the inspection. At that time the tank had not been cleaned for about five years.

Dosing chamber.— The dosing chamber is contained in a concrete house 8 feet by 25 feet in plan. In this house are contained the four automatic feed siphons, each connected to its corresponding contact bed. These siphons are supposed to be operated automatically and to divert the flow from one contact bed to another as soon as a bed is filled with sewage. At the time of the inspection, however, due to a leak in the air lock system, the sewage was all flowing continuously through one siphon and contact bed without any period of contact. It was stated by the superintendent that these siphons had been out of operating condition for about two months.

Contact beds.— Two of the contact beds are 24 by 125 feet in plan and the other two are 21½ by 134½ feet in plan with a small additional area 8 feet

by 12¾ feet. Each bed has an area of nearly 3,000 square feet and for the four beds the total area is equivalent to about .27 of an acre. The floor of the contact beds consists of concrete about 5 inches thick and the walls are of concrete 18 inches thick. The filtering material consists of 3 feet of broken stone ½-inch to 1 inch in size. In 1913 the contact filters had become clogged to such an extent that the old stone was removed and used for the construction of highways and new stone was placed in the contact beds. The old stone had been used about nine years.

The distributing system consists of a wooden trough 14 inches wide and 7 inches high on the surface of each bed. There are 2-inch circular openings at intervals of 4 feet in the bottom of the sides of the trough through which the sewage is discharged on the surface of the beds. The underdrain consists of two lines of 12-inch vitrified pipe laid with open joints, one line along each side of a bed. These underdrains are laid on the concrete floor and extend to the timed siphons located at the east end of the contact beds.

The rates of operation of the contact beds with the amount of sewage flowing as found during the inspection and with all the beds in use would be equivalent to 2,456,000 gallons per acre per day or 815,000 gallons per acre per foot in depth per day. Assuming the voids as 33 per cent of the space occupied by the stone, the quantity of sewage which each bed could receive would be about 22,500 gallons. It would, therefore, take about forty-three minutes under this rate of flow to fill one bed. Due to the inoperative condition of the dosing siphons the tank effluent was passing continuously through the north bed without any period of contact and was being discharged into the river.

Timed siphon.— There is a timed siphon to each of the contact beds and they are located in two concrete houses placed at the end and between the central and outside beds. They are supposed to discharge the sewage from a bed after it has remained standing in the bed a predetermined time. On account of the condition of the dosing siphons, these siphons were also out of operating condition and the sewage was passing continuously through the bed and the timed siphon which was being used.

Sludge disposal.— A concrete pump house 13 feet square is located west of and near the north end of the settling tank. In this house is a 3-inch centrifugal pump which is used for pumping sludge from the pump well. This well is adjacent to the grit chamber and is 13 feet square. The area west of the settling tank is supposed to be used as a sludge disposal field although it has never been used as such and a ditch extends from the sludge discharge pipe to the river. Sludge was removed from the settling tank about one year previous to the inspection and was placed on farm land about one-half mile from the plant. The settling tank had previously been cleaned out in the year 1909.

Cost and operation of plant.— The sewer system originally cost $60,248 and the disposal plant cost $10,000.

The superintendent of the municipal board has charge of the sewers and sewage disposal works. One laborer is employed at the plant whenever required. The average yearly cost and maintenance of the plant amounts to about $250. The new stone which replaced the old stone removed from the contact beds in 1913 cost $1,007,72 and the labor necessary to place the stone cost $353.80.

Efficiency of plant as determined by chemical analyses

In order to determine the efficiency of the disposal plant to properly treat the sewage contributed to it and also as a test of the operation of the different units comprising the plant, analyses were made of the sewage and of the different effluents and of the river water into which the effluent was discharged. The report of these analyses, which included the temperature of the samples,

gives the results of the tests for settling, turbidity, oxygen consumed, dissolved oxygen, chlorine, and putrescibility and the results are shown in the following table:

ANALYSES MADE MARCH 23, 1915

	Time	Temperature	Imhoff cone c. c. in 1 hour	Parts Per Million						Putrescibility, days
				Turbidity	Oxygen consumed, 10 min. boiling	Dissolved oxygen		Nitrates	Chlorine	
						Parts	Per cent of saturation			
Raw sewage.......	3 P. M...	45	1.0	90	48	2.5	21	....	45	2
Tank............	11 P. M...	......	....	..	196	2.1	18	....	45	....
Effluent...........	3 P. M...	45	0.7	82	44	....	......	....	....	2
Contact..........	11 A. M...	......	....	....	124	2.1	17	2.4	45	....
Bed effluent.......	3 P. M...	44	....	45	39	....	......	1.2	....	2 1/8
River above.......	11 A. M...	40	....	Clear	3.0	6.3	51	....	6	Over 20
River below.......	4 P. M...	44	....	Clear	3.2	6.3	52	....	6	Over 20

While the results of but one set of analyses may not represent average results of operation of the plant over a long time, especially since the contact beds were not being properly operated, they do, nevertheless show clearly the condition at the time of the inspection, which may be stated as follows:

Samples of the raw sewage could not be obtained in the morning since the plant was not accessible at that time. The tank effluent and filter effluent taken in the morning gave very high results in oxygen consumed test and this was due to the grape juice wastes which were being discharged into the sewage at that time. These wastes did not continue in the sewage during the afternoon and the discussion of the efficiency of the plant will be based upon the normal sewage as determined in the afternoon test.

The raw sewage as collected in the afternoon gave 1.0 cubic centimeters of readily settling matter and a turbidity of 90 parts. In the oxygen consumed test 48 parts were obtained and the chlorine test gave 45 parts. These tests indicated a sewage of about one-half the strength of the normal day flow of domestic sewage of a municipality of this size. These results are also verified by the per capita flow which is about twice that of the average municipality. The 2½ parts of dissolved oxygen indicated that the sewage was in a fresh condition as it reached the plant. The sample in the putrescibility test was stable for two days, which is about what might be expected during the cold weather prevailing at the time of the inspection and for the weak sewage which was being received.

The tank effluent as collected in the afternoon gave 0.7 c.c. of readily settling matter and indicated a removal of such suspended matter of only 30 per cent. The oxygen consumed test gave 44 parts as compared with the 48 parts in the raw sewage and indicated a reduction of only 8 per cent. The amount of dissolved oxygen, 2.1 parts, was only slightly smaller than that found in the raw sewage and this reduction was undoubtedly due to the bacterial action going on in the tank. The chlorine test as obtained in the morning sample gave about the same strength of sewage as that obtained in the afternoon sample of raw sewage. The chlorine determination would not be affected by grape juice wastes and therefore would indicate the character of the domestic sewage and not that of the trade wastes present.

Considering next the effluent from the contact beds, a sample of which was collected in the afternoon, it will be seen that the turbidity was 45 parts as compared with the 82 parts in the tank effluent. This represented a reduction of 45 per cent. The oxygen consumed test gave 39 parts as compared with

the 43 parts in the tank effluent and showed a reduction of the organic matter of 11 per cent. The dissolved oxygen gave 2.1 parts, which was the same as that found in the tank effluent. The 1.2 parts of nitrates was very low and the greater portion was probably due to normal nitrification which would be carried on in any sewage or water that contained dissolved oxygen. The putrescibility test of 2⅛ days plainly showed the unsatisfactory character of the final effluent and this effluent was stable only three hours longer than the raw sewage and tank effluent.

The water in the river above the discharge of the effluent was clear and gave three parts of oxygen consumed and six parts of chlorine. These results indicated comparatively little or no pollution. The 6.3 parts of dissolved oxygen corresponds to a saturation of 51 per cent. The sample was nonputrescible since it stood up over twenty days.

Considering finally the river water below the discharge of the effluent from the plant, it will be seen that the water was practically clear. The increase in oxygen consumed from 3 to 3.2 parts indicated the presence of the effluent and this small amount of increase is due to the large dilution which was being obtained at that time. The dissolved oxygen of 6.3 parts and the chlorine of 6 parts were practically the same as that of the river water above. The sample was also nonputrescible.

At the time of the inspection due to the large flow in the river, a condition of nuisance did not appear to exist. With the smaller flows of the summer and under the conditions of warm weather, the effluent, if discharged in the condition found during the inspection, is likely to cause a nuisance in the river below the discharge of the effluent, especially in still water above the mill dam.

Summary and conclusions

As a result then of the investigation of this plant and after careful consideration of the condition of operation and of the results of the analyses of samples from various parts of the plant, the following summary and conclusions are presented:

1. The excess amount of ground and roof water which is received at the disposal plant greatly overtaxes the plant.
2. On the morning of the inspection about one-third of the sewage was found by-passing the settling tank and contact beds.
3. The comparatively small theoretical detention period and the large amount of sludge and scum in the settling tank resulted in giving a comparatively poor effluent.
4. The dosing apparatus was not in an operating condition and the sewage was flowing continuously through the siphons and contact beds to the river.
5. With the excess amount of ground water in the sewage, the rates of operation of the contact beds are exceedingly high.
6. The contact filters were not operating as such and the sewage passing through one bed which acted as a strainer resulted in giving a decidedly poor effluent from the plant.
7. The facilities for the removal and final disposition of the sludge were insufficient, since there is no space reserved for the drying of sludge which is removed from the tank.

Recommendations

In view of the results of this investigation, I would recommend that the village authorities of Penn Yan be requested to make the following improvements in its sewer system and disposal plant in order that the plant may be

operated in the best possible manner to give an effluent which is suitable to be discharged into the river:

1. That on account of the excessive rates of filtration required at the plant in its present condition every effort be made to reduce and prevent further infiltration of ground water and the discharge of roof water into the sewer system.

2. That the by-pass which allows the sewage to flow directly to the river be not used except for the short time necessary in cleaning the tank.

3. That scum and sludge not be allowed at any time to accumulate in the grit chamber or in the settling tank to a greater extent than one-third the capacity of the chamber or of the tank.

4. That the dosing siphons be placed in proper operating condition and that they be so maintained.

5. That the depth of stone on the contact beds be raised 10 inches and the alternating feed and timed siphons be adjusted for the increased depth of the beds, in order that the present beds may be operated at a lower rate.

6. That contact beds be always operated as contact beds and not as coarse strainers.

7. That the area lying west of the settling tank be made into a sludge bed and sludge which is removed from the settling tank be dried on this area unless the sludge should be removed directly from the tank into tank wagons.

Respectfully submitted,

THEODORE HORTON,
Chief Engineer

ALBANY, N. Y., *May* 25, 1915

PLEASANTVILLE (Hebrew Sheltering Guardian Society)

HERMANN M. BIGGS, M.D., *State Commissioner of Health:*

I beg to submit the following report upon an investigation of the sewage disposal plant at the institution of the Hebrew Sheltering-Guardian Society, located at Pleasantville, Westchester county, made on September 16, 1914. This investigation was made by Mr. Morton F. Sanborn, assistant engineer, in connection with the general investigation of sewage disposal plants in the State now being carried on.

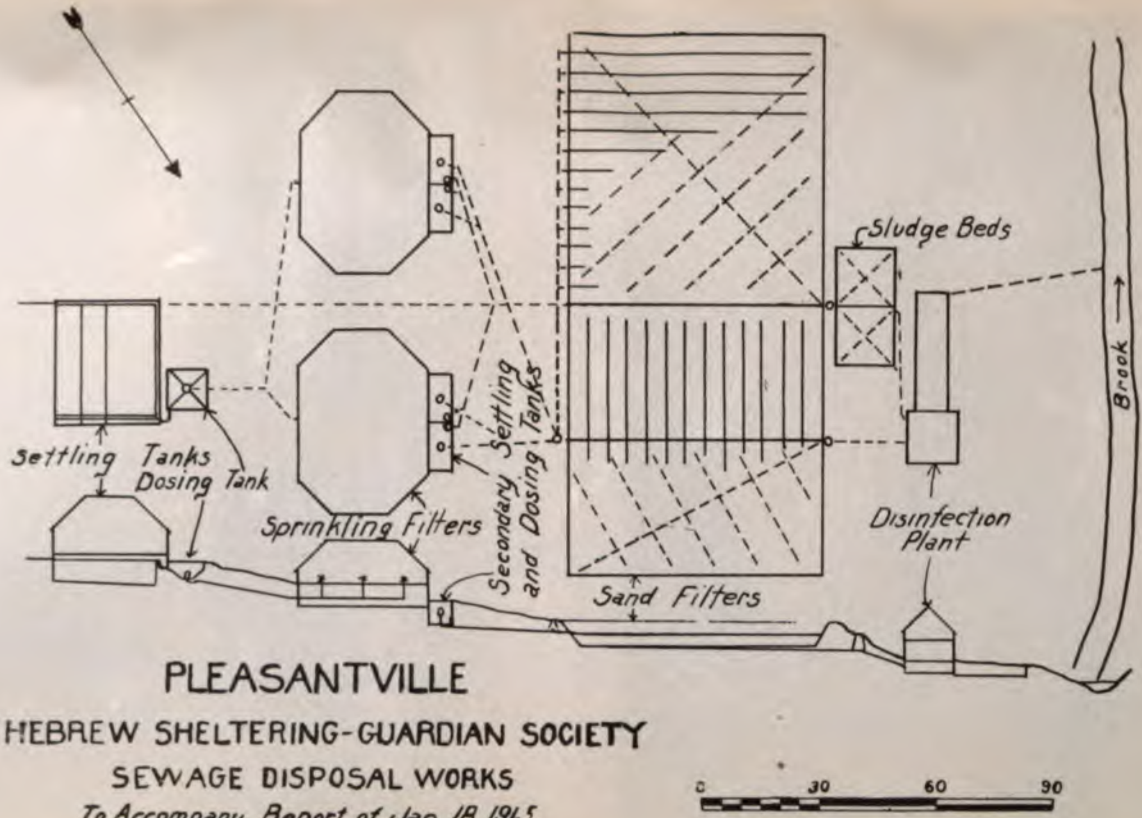
General description

This institution is a home for destitute Jewish orphan children, supported by the Jewish people and is located on a hill about one mile east of the Pleasantville station on the N. Y. C. & H. R. R., Harlem division. The population at the institution consists of 120 adults and 591 children.

The public water supply for the institution is taken from two driven wells located on top of the hill at the institution. The supply for boiler and laundry purposes is taken from the impounding reservoir of the Pleasantville water supply and is used without filtration. Assuming that the water consumption is the same as the average daily flow of sewage there would be an average daily consumption of 77 gallons per capita per day.

All the buildings at the institution are connected with the sewerage system and the sewage is conveyed to and passes through the sewage disposal works to the brook by gravity. The average daily flow of sewage is about 55,000 gallons, the maximum flow about 82,000 gallons and the minimum flow about 42,000 gallons. These results were obtained from the readings of a counter in the siphon chamber which gives the number of discharges of the siphon.

The disposal works were designed by Lederle & Provost, sanitary engineers of New York City, and the plans for the disposal works were approved on



PLEASANTVILLE

HEBREW SHELTERING-GUARDIAN SOCIETY

SEWAGE DISPOSAL WORKS

To Accompany Report of Jan. 18, 1915

about mid-depth while the third extends from the bottom up to about mid-depth and is used to retain the sludge near the inlet end of the tanks. Openings are provided between the tanks to allow the sewage to pass successively through each tank.

Under ordinary operating conditions the two small tanks are operated in series or the large tank is operated alone. In either case the same detention period of about 6½ hours is obtained under the average conditions of flow. The tanks are used until septic action creates a disturbance of the sludge. The length of time that the tanks are used varies from two months in the summer to four or five months in the winter.

Dosing tanks.— There is a dosing tank with a hopper-shaped bottom which contains a 6-inch simple automatic siphon. This siphon discharges the effluent of the sedimentation tanks to the sprinkling filter in doses of about 1,800 gallons, the tank being practically emptied at each operation of the siphon. A recording instrument has been placed in the tank which gives the number of discharges of the siphon.

Sprinkling filters.— The two sprinkling filters are octagonal in plan and have concrete bottoms, perforated concrete sides and wooden roofs. These filters have a combined area of about .054 acres and are filled with about 6 feet of broken stone of from ½ to 2 inches in size. Each filter has ten hexagonal Taylor nozzles and the distribution system is so divided that the nozzles are in two groups of five in each group. The nozzles are about 8 inches above the surface of the stone and under the varying head obtained by the use of the dosing tank and siphons the nozzles appear to give a satisfactory distribution of the sewage on the filters. The effluents from the sprinkling filters are discharged into the settling tanks located adjacent to the filters. Both filters are used continuously and with the average condition of flow the rate of filtration per acre would be about 1,020,000 gallons per day or 170,000 gallons per acre per foot in depth.

Secondary sedimentation.— Two combination sedimentation and dosing tanks were constructed below each sprinkling filter so that each unit of the filter discharged into its corresponding tank. The tanks are of concrete 12 feet, 2 inches by 5½ feet in plan and 4½ feet deep. It was found that the intermittent discharge of the siphons located in the tanks stirred up the sludge and caused the effluent at times to carry considerable suspended matter to the sand filters. The operation of the tanks at each filter was changed so that one tank acts as a settling tank, the effluent from which passes over a weir to the second tank which is used as a dosing tank. The sedimentation tank as now used has a capacity of about 2,260 gallons. With all the filters in use the detention period is about two hours for each of the two tanks. This settling period is longer than is necessary and if the sludge is left in the tanks too long septic action is apt to occur and give a putrescible instead of a non-putrescible effluent. This is guarded against by cleaning the tanks whenever the samples, collected regularly show putrescibility by the methylene blue test in a few days, or when the effluent has a high turbidity. The dosing tanks are of the same size as the settling tanks but have a lesser available depth and each tank discharges about 1,360 gallons at intervals of about eighty minutes.

Sand filter beds.— Two of the filters are 34 ft. x 64 ft. in size and the third filter is 68 ft. x 68 ft. This gives a total area of .2 of an acre. The sewage is distributed on the beds by means of several lines of 4-inch half round tile laid 5 feet apart on the surface of the beds. The filters are underdrained by 6-inch tile pipe extending diagonally across the beds with laterals of 4-inch tile every 10 feet. At the bottom of each bed is a 6-inch layer of gravel graded from 2 inches to ¼ inch in size and above this layer is 3 feet of filtering sand, of an effective size of 0.22 mm. and a uniformity coefficient of 3.0. Each discharge of the siphon will flood one of the small beds to a depth of about 1 inch and the larger bed ½ inch. These doses are applied at the rate of two in about eighty minutes. With all the beds in use and under the average conditions of sewage flow the rate of application would be about 275,000 gallons per acre per day. The beds are so operated as to give an equal distribution of sewage over the entire sand filter area in cycles of four days and this is

accomplished by having the large bed in use every other day and each of the small beds every fourth day. The beds are ridged during the winter by excavating shallow trenches in the sand between the distributing troughs and placing the sand over the distributors. The first length of each line of distributing tile is removed and the sewage is applied through the several openings in the bank where the tiles were removed. About every six weeks the beds are put out of use in order that the scum which has formed on the surface may dry and be removed. After the beds had been in operation two years it was necessary to place about 6 inches of new sand on the beds to replace the sand removed during the scrapings.

The rate of filtration is fairly high but if the beds are operated with care and are cleaned whenever they show indications of being clogged and if the effluent from the sprinkling filters is properly settled to remove the turbidity, the filters should continue to operate satisfactorily.

Sterilization or disinfection tanks.— The effluent of the sand filters is treated with hypochlorite of lime before it is discharged into the stream. The apparatus for handling and applying the bleach is contained in a two-story frame building about 15 feet square. On the upper floor are two mixing tanks each consisting of a length of 20-inch tile pipe 3 feet long. On the floor below are two storage tanks consisting of two 2-foot lengths of tile pipe, 2 feet in diameter. The tanks are made air tight inasmuch as it is essential to the proper operation of these tanks that no air should be admitted to them except through the discharge pipe. The discharge valve of each tank is contained in a length of 3-inch special tile pipe extending downward from the bottom of the storage tanks. Surrounding the bottom of the discharge pipe is a small iron box having a small orifice in one side slightly below the bottom of the discharge pipe.

The bleach is first mixed with water in a pail and then poured into one of the mixing tanks which had been previously filled with water. After being thoroughly mixed, the bleach solution is discharged into one of the storage tanks below until it is completely filled to displace all the air. The upper valve is then closed and the lower valve is opened which allows the orifice box to fill until the solution rises to the bottom of the draining valve and automatically cuts off the flow of air into the tank and consequently the discharge of bleach from the tank. The rate of flow is regulated by the difference in elevation between the orifice and the open end of the discharge pipe. If the storage tanks are not kept perfectly air-tight the flow of the disinfectant must be controlled by the discharge valve in which case the flow is very easily stopped if some of the lime settles in the valve.

Below the ground floor of the house is a storage and dosing tank that receives the effluents of the sand filters and sludge beds. The bleach solution is applied to the effluent of the sand filters as it enters the tank. This tank is about 13 feet square, has an available depth of 2 feet and a capacity of about 2,535 gallons. This tank is used for the purpose of giving a detention period to the effluents in order that the bleach may have time to act after which the treated effluents are discharged intermittently into a baffled chamber before passing to the brook. This baffled chamber is 27 feet long, 8 feet wide and 1½ feet deep. The effluent from the chamber flows over an 8-inch circular weir into the outlet pipe leading to the brook.

The sterilization plant as built varies considerably from the plans as approved by this Department, particularly in the arrangements of application of the bleach solution and the construction of the floors of the house.

Five pounds of bleach are used during the ten-hour period from 7 A. M. to 5 P. M. and five pounds during the fourteen hours from 5 P. M. to 7 A. M. With the average flow of sewage of 55,000 gallons per day this amount of bleach used would give a rate of about 14 parts of available chlorine per million parts of effluent treated.

Sludge disposal.— The sludge from the primary settling and the final settling tanks is disposed of on two sludge beds each 15 feet square.

These beds are filled to a depth of about 6 inches with sifted boiler ashes covered with a thin layer of sand and are drained by lines of 4-inch tile pipe

Location and general description

Location.— On the Pocantico Hills, Pleasantville road. About 1½ miles northeast of Pocantico Hills

Population.— The population at the time of inspection was 143

Institution water supply.— Private well near pond

Sewer system.— 1,500 feet of 5-inch sanitary sewers

Sewage disposal plants.— The main plant consists of 2 settling tanks, a dosing tank, and a broad irrigation field. A description of the small plant (for the Annex) will be found in the attached supplementary report.

This college is a Catholic institution at which young men are trained for service in the Catholic church. The number of people at the institution at the time of the inspection was about 143 and during the summer months the number is increased by about 50 people.

The water supply is obtained from a driven well near the pond and is pumped to a standpipe. It is used by the inhabitants without being filtered. No figures of water consumption could be obtained and, therefore, an assumed consumption of 100 gallons per capita per day is used in this report. This would be equivalent to 14,300 gallons per day.

The sewer system consists of about 1,500 feet of 8-inch pipe leading to the main disposal plant. Due to the irregular flow of sewage no measurements could be obtained and, therefore, the sewage flow was estimated at the same as that estimated for the water consumption, i.e. 100 gallons per capita per day, or a total of 14,300 gallons per day.

The main disposal plant was designed by Waring, Chapman and Farquhar civil engineers of New York City and the plans were approved by this Department on February 26, 1906. This disposal plant was constructed under the direction of Waring, Chapman and Farquhar and was completed and placed in service in October, 1906.

The effluent from the disposal plant flows into a small brook which is tributary to Pocantico river. Since this brook rises on the property of the college it has practically no watershed and the brook is fed by springs and the effluent from the disposal plant. About three miles below the discharge of this effluent the water is taken for a public water supply by the Consolidated Water Company of Suburban New York and is used by the village of North Tarrytown and adjacent villages. This water is filtered in mechanical filters and is sterilized with hypochlorite of lime before being used.

Description of sewage disposal works

Site.— The main disposal plant is located about 1,200 feet from the main building of the college and about 200 feet from the pond which is used for bathing and from which ice is taken during the winter.

Sedimentation tanks.— The two sedimentation tanks are 10 feet by 3 ½ feet in plan and 3 feet 7 inches deep giving a capacity for each tank of 940 gallons. With the estimated amount of sewage of 14,300 gallons per day, the combined capacity of the two tanks is sufficient to give a theoretical detention period of 3 hours. The tanks and dosing chamber are constructed throughout of concrete and the roof is covered with about 18 inches of earth. The tanks are arranged in parallel. The raw sewage enters each tank at the flow line through a 6-inch pipe from an inlet chamber. The effluent leaves each tank through a trapped 6-inch pipe, the open end of which is about 1 ½ feet below the surface. Sludge pipes are provided for the removal of sludge from the two settling tanks. The settling tanks were nearly filled with sludge and scum which prevented proper settling of the sewage.

Dosing tank.— The dosing tank is a separate compartment of the settling tank structure and is also constructed of concrete. This tank is 27 feet by 8 feet in plan and probably has an available depth of about 2 ½ feet. This gives a capacity of about 4,000 gallons which is sufficient to give about 3½ flushes a day under the estimated amount of flow. A 6-inch simple automatic siphon is located in a 3 feet by 4 feet siphon chamber built adjacent to the

tanks. The inlet of the siphon is located in a depression in the floor of the chamber and, therefore, the tank is practically emptied at each discharge. About 2 inches of sludge was in the tank at the time of inspection.

Broad irrigation field.— The disposal field is about 450 feet long and 135 feet wide and contains 63,450 square feet or nearly 1½ acres. The field is located on a gentle slope of the ground and has a total slope of 11 feet in its width of 135 feet. This gives a slope to the field of about 8 per cent. The field is divided into 6 units, three on the upper side and three on the lower side. The flow to each unit is controlled by shear gates. Across the upper side of each unit extends a wooden trough having 1 inch by 2 inch openings every 2 feet in the bottom of the side to permit the sewage to flow to the field. Three inch underdrains every 25 feet are laid 4 feet below the surface from the upper side of the field to the lower side at which place they connect with a 4 inch main collector. This main collector conveys the effluent to the brook below the pond.

With all the field in use the rate of application of the sewage to the field is equivalent to 10,000 gallons per acre per day or to 100 persons contributing sewage per acre. At the time of the inspection all of the beds were in use and the sewage disappeared in the ground before reaching the lower portion of the beds. The entire area was covered with sod and on the parts of the field nearest to the discharge of sewage, the grass was green and appeared to be growing in spite of the cold weather which prevailed previous to the inspection.

Sludge disposal.— The sludge drain from the settling tanks leads to a sludge bed located between the tanks and the irrigation field. This bed is about 30 feet by 5 feet and is of sufficient size to receive the sludge from the tanks.

Operation of the plant.— One of the brothers at the college has charge of the water and sewage works but due to his illness he could not be seen by the inspector. It was stated at the college that the settling tanks were cleaned out every few months, but due to the illness of the man in charge the tanks had been run longer than usual before cleaning.

Efficiency of plant as determined by chemical analyses

In order to determine the efficiency of this disposal plant to properly treat the sewage contributed to it and also as a test of the efficiency of the different units comprising the plant, analyses were made of the sewage of the different effluents and of the water from the brook into which the effluent was discharged. The report of these analyses, which includes the temperature of the samples, gives the results of the tests of settling, turbidity, oxygen consumed, dissolved oxygen, nitrates, chlorine and putrescibility and these results are shown in the following table:

ANALYSES MADE ON DECEMBER 15, 1914

Disposal	Temperature	Imhoff cone c.c. in 1 hour	Parts per Million						Putrescibility, days
			Turbidity	Oxygen consumed, 10 min. boiling	Dissolved oxygen: Parts	Dissolved oxygen: Per cent of saturation	Nitrates	Chlorine	
Raw sewage	58°	10	350	164	1.8	18	....	120	7/12
Tank effluent	47°	25	1,000	320	0.8	7	....	500	1/3
Pond	43°	......	.....	7.8	6.2	50	1.2	16	Over 20
Stream below	43°	......	.....	9.2	4.0	35	4.7	30	Over 20

While these analyses may not represent average conditions of operation of the plant over a long time, they do, nevertheless, show clearly the efficiency of

the plant at the time of the inspection and the results of the analyses together with the efficiency of the different units will be stated as follows:

The raw sewage as received at the disposal plant indicated a strength of about 50 per cent greater than the average domestic sewage of a small municipality. This is shown in the tests for turbidity, oxygen consumed and chlorine. The high result in the Imhoff Cone test is due to the strength and to the fresh condition of the sewage. The sewage became putrescible in 14 hours and is about what could be expected from sewage of this character.

Due to the uncertainty of the time of discharge from the dosing tank one of the men at the college obtained the samples at about 1:30 P. M. He was instructed to wait about five minutes after the siphon started before taking the samples. The analysis plainly shows the effect of sludge carried out from the settling tank and dosing chamber. This analysis manifestly does not show the average effluent but it does show that the tanks were overloaded with sludge. The high chlorine could not be accounted for although it was probably due to an excessive amount of salt in the kitchen wastes in that particular lot of sewage and, therefore, the determination of chlorine does not give a true indication of the strength of the sewage.

No samples of the effluent of the irrigation field could be obtained since it flowed through a drain pipe and united under the ground with the water from the pond.

The water of the pond which is above the discharge of the effluent had 7.8 parts of oxygen consumed and 16 parts of chlorine and both of these results indicated contamination. The 1.2 parts of the nitrates indicates the nitrification of organic matter which had previously entered the water of the pond. The 5.2 parts of dissolved oxygen indicated a fair amount of oxygen present in the water. The water was nonputrescible. The contaminated condition of the pond water was probably due to the effluent from the broad irrigation field reaching the pond either by flowing through the ground or by direct flow from the effluent pipe.

The water in the stream below the pond consisted largely of the effluent from the irrigation field. The analysis of this water gave 9.2 parts of oxygen consumed as against 7.8 parts found in the pond water and plainly indicated the addition of the effluent. The increase in the chlorine from 16 parts in the pond water to 30 parts in the brook water also indicated the presence of the effluent. The 4 parts of dissolved oxygen as against the 6.2 parts in the pond water was due to a smaller amount contained in the effluent. In the nitrate test 4.7 parts were found which indicated considerable organic matter that had been converted into nitrates. The sample was nonputrescible.

At the time of the inspection the water of the brook was clear and the bed of the brook did not show any fungus growth which often grows in the presence of sewage effluents.

Summary and conclusions

As a result then, of the investigation of this plant and after careful consideration of the condition of operation and the results of analyses of samples from various parts of the plant the following summary and conclusions are presented:

1. Due to the excessive amount of sludge and scum in the settling tanks practically no sedimentation was being obtained and in fact, the effluent tested gave a strength from 2 to 3 times greater than the raw sewage tested.

2. The sludge in the dosing tank undoubtedly caused some of the high turbidity in the effluent since some of it would be flushed through the siphon at each discharge.

3. The high oxygen consumed and chlorine results of the pond water would indicate pollution and, therefore, the use of the pond for bathing and the use of ice from the pond to place in drinking water or to come in direct contact with food is somewhat questionable.

Recommendations

In view of the results of this investigation, I would recommend that the authorities of St. Joseph's Normal College be requested to make the following changes in the operation of the disposal plant in order that the plant may at all times, be maintained in an efficient operating condition:

1. That the sludge and scum in the settling tanks be removed and at no time should more than 1/3 of the capacity of the tanks be occupied with scum and sludge.
2. That the sludge in the dosing tank be cleaned out at frequent intervals.

Respectfully submitted,

THEODORE HORTON,
Chief Engineer

ALBANY, N. Y., *March* 19, 1915

Supplementary report describing disposal plant at annex to accompany principal report of inspection of sewage disposal plant at St. Joseph's Normal College, dated March 19, 1915

This plant is in use only when the Annex is being used and, therefore, it is used only about two months during the summer. The plant was looked over in a general way but since the plant was not being used no idea could be obtained as to its efficiency. The maximum number of persons contributing to this plant at any time is about 58.

The plant consists of a settling tank, dosing tank, subsurface irrigation field and a sludge tank. There is about 100 feet of 6-inch tile pipe which conveys the sewage from the Annex to the settling tank.

The disposal plant for the Annex was designed by C. F. Archer, civil engineer of New York City, and the plans were approved by this Department on August 5, 1912. This plant was constructed soon after the approval of the plans and its construction was superintended by Mr. Archer.

The effluent from the disposal plant is supposed to be taken care of under ground although the water would eventually reach the same brook as that into which the effluent from the main plant is discharged.

Site.— This disposal plant is situated on the side of the hill about 100 feet from the Annex and about 500 feet from the pond mentioned in the main report.

Settling tank.—A circular concrete settling tank 8 feet in diameter and 5 ½ feet deep is provided for the removal of settling matter contained in the sewage. A partition wall divides the tank into two equal parts. The capacity of the settling compartment amounts to about 1,800 gallons and this would be equivalent to about 1/3 of the maximum amount of sewage contributed per day with an assumed flow of 100 gallons per capita. The sewage enters one part and passes through a trapped connection to the other part and thence out through a 6 inch pipe which acts as a weir. A sludge drain is provided for the removal of sludge from the first settling compartment.

Dosing tank.— The dosing tank is 4 feet by 8 feet in plan and has an available depth of about 18 inches. This gives an amount of sewage discharged at each operation of the siphon of a little over 360 gallons. The tank is constructed of concrete. A 3-inch simple automatic siphon is provided to give intermittent discharge of the sewage to the subsurface disposal field.

Subsurface disposal field.— The disposal field is located about 40 feet from the settling tank and consists of several lines of 3-inch tile laid in gravel one and two feet below the surface. The permit called for 3,000 feet of tile laid in several lines at least four feet apart. The area of this field could not be verified on account of the growth of brush and grass and since the man in charge of the plant was ill.

Sludge disposal.— The sludge drain from the settling tank leads to a concrete sludge chamber built adjacent to the dosing tank. This chamber is 4 feet by 12 feet in plan and about 4 feet deep and, therefore, has a capacity of about 192 cubic feet. This chamber is of ample size to hold the sludge of several years summer operation of the plant.

Summary and conclusions

The area of the subsurface disposal field could not be determined but from the area evidently cleared for the disposal field, it did not appear to occupy more than one-half of the area called for by the permit although the entire 3,000 feet of pipe may have been laid.

From the inspection of this plant it would appear, however, that the settling tank, dosing tank and sludge tank had been constructed according to the approved plans and should operate satisfactorily, provided they are maintained in an effective condition.

ROME (State Custodial Asylum)

HERMANN M. BIGGS, M. D., *State Commissioner of Health:*

I beg to submit the following report upon an investigation of the sewage disposal plant at the Rome State Custodial Asylum at Rome, Oneida county, made on November 13, 1914. This investigation was made by Mr. Morton F. Sanborn, assistant engineer in connection with the general investigation now being carried on of sewage disposal plants in the State and as the result of a request from the Superintendent that an inspection of the plant be made with a view of making recommendations for its improvement.

General description

The Rome Custodial Asylum is situated in the city of Rome about two miles southwest of the main part of the city and is an institution that ministers to those who have mental defects, many of which are intimately associated with physical defects such as alcoholism, convulsions, epilepsy and physical deformities. At the time of the inspection there were about 1,464 inmates and 222 officials and attendants at the institution. The average number of inmates cared for during 1909 was about 1,200. These figures show an increase of about 264 inmates during the last five years and plans are now under way for an additional building having a capacity for 200 inmates.

The institution is pleasantly situated on a slight rise of land with the ground in front sloping down to the general level of the plain through which passes the New York Barge Canal. In the rear the ground rises slightly and is used for agricultural purposes. The principal buildings are connected and in general the plan consists of one main building from which the other buildings extend out on all sides. There are also several detached buildings as the laundry, the boiler house, the stable, etc.

The water supply of the institution is obtained from the municipal supply of the city of Rome. This water is obtained from Fish creek and used without purification. The average daily consumption as computed from the flow of sewage is estimated at about 90 gallons per capita.

The sewer system consists of a sanitary sewer which connects with the different buildings and conveys the sewage to the disposal plant, and of a storm water drain that receives the roof and surface water. Grease traps are placed in the kitchen for the removal of grease before the wastes are discharged into the sewer. The approximate daily flow of sewage as measured at the inlet to the disposal plant on the day of inspection was about 150,800 gallons which correspond to a sewage flow per capita of about 90 gallons.

The plans for the sewage disposal works were prepared under the supervision of the State Architect and approved by this Department on August 27, 1909. On May 24, 1910 plans providing for the separation of the sanitary sewage and storm water were approved. The disposal plant was completed and put in service during the fall of 1911.

The disposal plant is located in a field near the foot of the slope in front of and about 1,100 feet from the buildings of the institution and about 500 feet from the nearest road. The effluent from the disposal plant is discharged into an open ditch which runs northwesterly to the N. Y. C. & H. R. R. and thence along the railroad track in a northeasterly direction to the canal which is about two miles from the plant. Except during times of rain the effluent receives but little dilution before it reaches the canal.

Description of sewage disposal works

The disposal plant consists of a settling tank, dosing tank, sprinkling filter and final settling basin. The settling tank and dosing chamber are located about 500 feet from the road while the sprinkling filter and final settling basin are located at the foot of the slope and about 500 feet from the settling tank. The dosing tank is built adjacent to the settling tank and the final settling basin is located immediately below the sprinkling filter.

Settling tank.—The settling tank is a concrete structure 25 feet wide x 33 feet long at the top and has a maximum depth of 11 feet. The inner face of the walls of the tank has a batter of 1½ feet in a depth of 6½ feet. From the bottom of the four walls the bottom of the tank has a slope of 4½ feet in a horizontal distance of 7 feet 9 inches. The central portion of the bottom is level and is 6½ feet wide x 14½ feet long. The flow line of the sewage in the tank is 6 inches below the top. The tank is divided by means of partitions into two parallel settling compartments and one central sludge compartment which is 6 feet wide. A cover over the sludge compartment and the partitions between the sludge and settling compartments for a distance of about 2 feet below the top are constructed of concrete. The sides or partitions below the concrete are of timber. The vertical sides of the sludge compartment extend to a point about 6 feet below the flow line of the tank and from this point the partitions have a slope of about one on two and meet the sloping bottom of the tank about midway between the top and bottom of the slopes thus forming with the concrete slopes the bottoms of the settling compartments. At the bottom of each of the wooden slopes are four openings about 6 inches by 2 feet to allow the sludge to enter the sludge compartment.

The capacity of the settling compartments is about 27,200 gallons and the detention period with the amount of sewage flowing as found during the inspection, would be about 4⅓ hours. The total capacity of the sludge compartment is about 16,600 gallons.

The sewage enters the settling compartments through four 6-inch openings, two in each compartment, about 3 feet below the surface of the sewage in the tank. About 2 feet from the outlet end of each tank is a scum board which extends from about 6 inches below the surface of the sewage in the tank to about 8 inches above the surface. A weir of sheet iron extends across the end of each tank over which the sewage flows into a collecting trough. From this trough are two openings through which sewage flows to the dosing tank built in connection with the settling tank.

Sludge is removed through two lines of 6-inch pipe discharging into the old abandoned sewer passing the plant. These 6-inch drain pipes enter the tank about 5 feet above the bottom and then turn downward to a point near the bottom of the tank where each pipe has two openings through which the sludge enters. A gate valve on each line regulates the flow of sludge from the tank.

On account of the small size and small number of the openings between the settling and sludge compartments very little sludge reaches the sludge chamber. The sewage seems to contain considerable quantities of grease and other substances and the presence of this grease coupled with the putrefactive action taking place in the tank causes practically all of the sludge to rise

and form a compact scum. At the time of the inspection the scum was about 18 inches thick. The scum was last removed about three months previous and at that time was said to be about 4 feet deep. The concrete roof over the sludge compartment prevents the removal of any scum from this compartment and the efficiency of the plant is decreased considerably on that account. The flat bottom of the sludge compartment does not facilitate the flow of sludge to the sludge drains.

Dosing tank.—A dosing chamber 8 ft. 11 in. x 10 ft. 2 in. and 7 feet deep is located adjacent to the settling tank and was presumably designed to give a discharge under a varying head to the sprinkling filter. This chamber is divided into four compartments, three of which are about 3 ft. x 3 ft. in plan. The other is 5 ft. 2 in. x 10 ft. 2 in. at the top with one end tapering toward the bottom which is 3 ft. x 5 ft. 2 in.

The effluent from the settling tank flows into one of the small tanks and then through a submerged outlet into the second small tank. From this tank the sewage overflows into the large tank and is discharged through pipe in the bottom to the distributing system of the sprinkling filter.

The chamber is apparently designed to give a continuous and varying amount of flow of sewage to the sprinkling filter. This varying flow is apparently obtained by means of air pressure from the third small tank by storage in the large settling tank, obtained by controlling the flow from the tank and by throttling the effluent pipe leading to the filter. At the time of the inspection the apparatus was not working properly and no one at the institution knew how to operate it or had ever known of it operating automatically.

Sprinkling filter.—The sprinkling filter is 65 feet square and the area is therefore 4,225 sq. ft. or .10 of an acre. The bottom of the filter is of concrete from 3 inches to 5 inches thick. Around the filter is a concrete retaining wall three sides of which are about 6½ feet high and the fourth side is about 3 feet 3 inches high. The filtering material consists of about 6 feet of crushed rock placed as follows: The bottom layer 1 foot thick is of stones about 3 inches in size, the next 4 feet consist of stone 1 inch to 2 inches in size and the upper layer 1 foot thick was ½ inch to 1 inch in size. Previous to inspection the upper 2 feet of the filtering material had been dug over so that the size of the stone in this portion of the filter varies from ½ to 2 inches.

The settled sewage from the dosing tank is applied to the surface of the sprinkling filter by means of twenty-five square spray Taylor nozzles spaced 13 feet on centers. These nozzles are placed in five rows with five in a row and each row is controlled by a gate valve thus allowing any row to be cut out of use.

There are five lines of underdrains consisting of channels, in the concrete bottom of the filter, covered with 9 in. by 12 in. by 2 in. book tiles with ½ inch open joints. These channels connect with a larger channel or drain which discharges the effluent through an 8-inch pipe leading to the final settling basin.

The rate of filtration with the amount of sewage flow as found during the inspection was about 1,508,000 gallons per acre per day or 251,000 gallons per acre per foot of depth per day. At the time of the inspection, the siphon tank was not operating properly, as the sewage flowed continuously to the filter under a comparatively low head to the fifteen nozzles in use. This low head on the nozzles resulted in the sewage being applied to the bed in circules 3 feet or less in diameter giving very poor distribution of the sewage on the surface of the bed.

Final settling basin.—The plans show a final settling basin, 10 ft. x 20 ft. on the bottom, constructed in the earth. The basin was planned to be 5 feet deep and was shown with sides having slopes of 1 to 1. This basin was not built according to the plans or it has been filled up and the sides caved in so that at present the basin is but little larger than the ditch into which the effluent is finally discharged. No sedimentation is obtained and the effluent passes practically unchanged from the sprinkling filter to the ditch that conveys it to the canal.

Sludge disposal.—A low field west of the sprinkling filters as shown on the plans was to be used for the disposal of sludge from the large settling tank.

The sludge will flow by gravity to this field which is supposed to be furrowed to receive the sludge. This field has apparently never been used and the sludge pipe extends to the ditch into which the effluent discharges. The sludge pipes are opened every month or two and only a small amount of sludge is discharged since fresh sewage soon begins to flow. The tanks are generally partially cleaned by removing the scum which is placed on the ground near the tanks and allowed to dry after which it is hauled away and used as fertilizer.

Efficiency of plant as determined by chemical analyses

In order to determine the efficiency of the disposal plant to properly treat the sewage contributed to it and also as a test of the efficiency of the different units comprising the plant, analyses were made of the sewage and different sewage effluents. These analyses included tests of settling in the Imhoff cone, turbidity, oxygen consumed, dissolved oxygen, nitrates, chlorine and putrescibility. The results are given in the following table:

ANALYSES MADE ON NOVEMBER 13, 1914

	Time	Imhoff cone c.c. in 1 hour	Parts per Million					Putrescibility, days
			Turbidity	Oxygen consumed, 10 min. boiling	Dissolved oxygen, parts	Nitrates	Chlorine	
Raw sewage	11 A. M.	6.5	300	168	1.7	....	64	....
Tank effluent	12 M.	6.2	260	86	1.1	....	80	....
Filter effluent	12 M.	1.3	140	56	1.6	1.3	104	7/8

While the results of but one set of analyses may not represent average results of operation of the plant over a long time they do, nevertheless, show clearly the condition of the operation and the efficiency of the plant at the time of the inspection, which may be stated as follows:

The raw sewage as received at the plant at the time of inspection was about one and one-half times as strong as the average domestic sewage of a small municipality as shown by the tests for readily settling matter, turbidity and oxygen consumed. These high results are probably due largely to washings and laundry wastes since the chlorine which is present in domestic sewage and is naturally absent in laundry wastes, in the test gave about two-thirds of the chlorine usually found in the average domestic sewage. The 1.7 parts of dissolved oxygen indicated that the sewage was fresh and in an aerobic condition.

In the analysis of the effluent of the settling tank the oxygen consumed test showed 86 parts of oxygen consumed as compared with 168 parts in the raw sewage and indicated a reduction of organic matter of about 49 per cent. The settling test gave 0.20 cubic centimeters of readily settling matter as compared with the 6.5 c.c. found in the raw sewage and this reduction showed a good percentage of removal of settling solids. The turbidity test gave 260 parts in the effluent and as the raw sewage had 300 parts the reduction was only about 20 per cent, due to the removal of suspended matter. Most of the remaining turbidity was due to finely divided suspended matter which did not readily settle. The 1.1 parts of dissolved oxygen showed that the effluent lost only a part of its available oxygen under septic action in the tank and this may be due partially to a somewhat rapid flow through the tank. The 84 parts of chlorine indicated a sewage of slightly stronger character than that of the raw sewage tested and this is probably due to fact that the sewage reached the plant earlier in the morning.

The results of these analyses made at the time of the inspection may be stated as follows:

The raw sewage as received at the disposal plant during the inspection was about two-thirds the strength of the average day flow of domestic sewage of a municipality of this size. This is shown by the 210 cubic centimeters of readily settling matter, the 160 parts of turbidity, the 68 parts of oxygen consumed and the 100 parts of chlorine. The high chlorine is partly due to the 30 to 50 parts of chlorine contained in the public water supply while the remainder is caused by the chlorine in the sewage. The 5.5 parts of dissolved oxygen plainly indicated that sewage as received at the plant was in a fresh condition. The putrescibility of 1⅙ days is accounted for by the large amount of dissolved oxygen present in the original sample to the cold weather prevailing at the time of inspection which retarded the growth of the bacteria.

As the disposal plant was not in operation, therefore, no tests of the effluent from the plant could be made.

The river water above the disposal plant contained 6.5 parts of turbidity which was partly due to the construction work being carried on for the new canal. The 5.1 parts of oxygen consumed indicated only slight pollution above the plant. The dissolved oxygen test of 8.7 parts showed a high amount of oxygen in the water. The chlorine test of 71 parts, while very high for the average river water, is due chiefly to the chlorine found in the natural waters of that part of the State.

No samples were taken from the river below the discharge since the dilution afforded by the river water at the time of inspection was over 1 to 1,000 and presence of the sewage could hardily have been detected. Due to the construction work for the canal no physical evidence of pollution of the river could be detected by growths on the bed of the river except for about 100 feet below the Elm street outlet at which place, the sewage flows through a small piece of marsh.

Summary and conclusions

As a result, then, of the investigation of this plant, and after careful consideration of the condition of operation and the results of analyses of the sewage and river water, the following summary and conclusions are presented:

1. Due to the faulty construction of the Elm street sewer all sewage from that district was flowing directly to the river without passing to the disposal plant.
2. The screen was not being maintained in an efficient condition since the screen was clogged and the sewage was flowing over the top and since the screenings removed from screen were placed back in the sewage and allowed to flow through the tanks or to the river.
3. The pipes leading to the tanks supposed to be in use, were clogged and, therefore, all the sewage received at the plant was flowing through the by-pass to the river.
4. That the excessive amount of scum and sludge in the grit chamber and settling tanks would have prevented proper sedimentation of the sewage if the sewage had been flowing through the chamber and tanks.

Recommendations

In view of the results of this investigation, I would recommend that the village of Seneca Falls be requested to make the following changes in the construction and operation of the sewer system and disposal plant in order that they may be placed in an efficient operating condition.

1. That the elevation of the overflow in the Elm street sewer be raised sufficiently to cause all the dry weather flow of sewage to pass to the disposal plant.
2. That the screen be maintained in an efficient condition and that the screenings be properly disposed of other than by placing them back in the sewage to pass into the settling tanks or to the river.

3. That the grit chamber and settling tanks be maintained in an efficient operating condition and that any accumulation of sludge in the tanks to a greater extent than one-third of their capacity be prevented at all times.

4. In view of the unwarranted use of the by-pass and to the fact that a by-pass is unnecessary by reason of the tank having several compartments, I would recommend that the by-pass be closed with a bulkhead which will prevent any sewage from by-passing the plant.

Respectfully submitted,

THEODORE HORTON,
Chief Engineer

ALBANY, N. Y., *February* 23, 1915

SHARON SPRINGS

HERMANN M. BIGGS, M.D., *State Commissioner of Health:*

I beg to submit the following report on an investigation of the sewage disposal plant of the village of Sharon Springs, Schoharie county, made on March 18 and 19, 1915. This investigation was made by Mr. Morton F. Sanborn, assistant engineer, in connection with the general investigation of disposal plants in the State now being made.

Location and general description

Location.—34 miles west of Schenectady and 8 miles south of the Mohawk river; on the Cherry Valley branch of the D. & H. R. R.

Population.—500 estimated at the time of inspection and about 2,500 for a short time in the summer.

Public water supply.— Municipal from small brooks.

Sewer system.—3 miles of sanitary sewers, 4 to 15 inches in diameter.

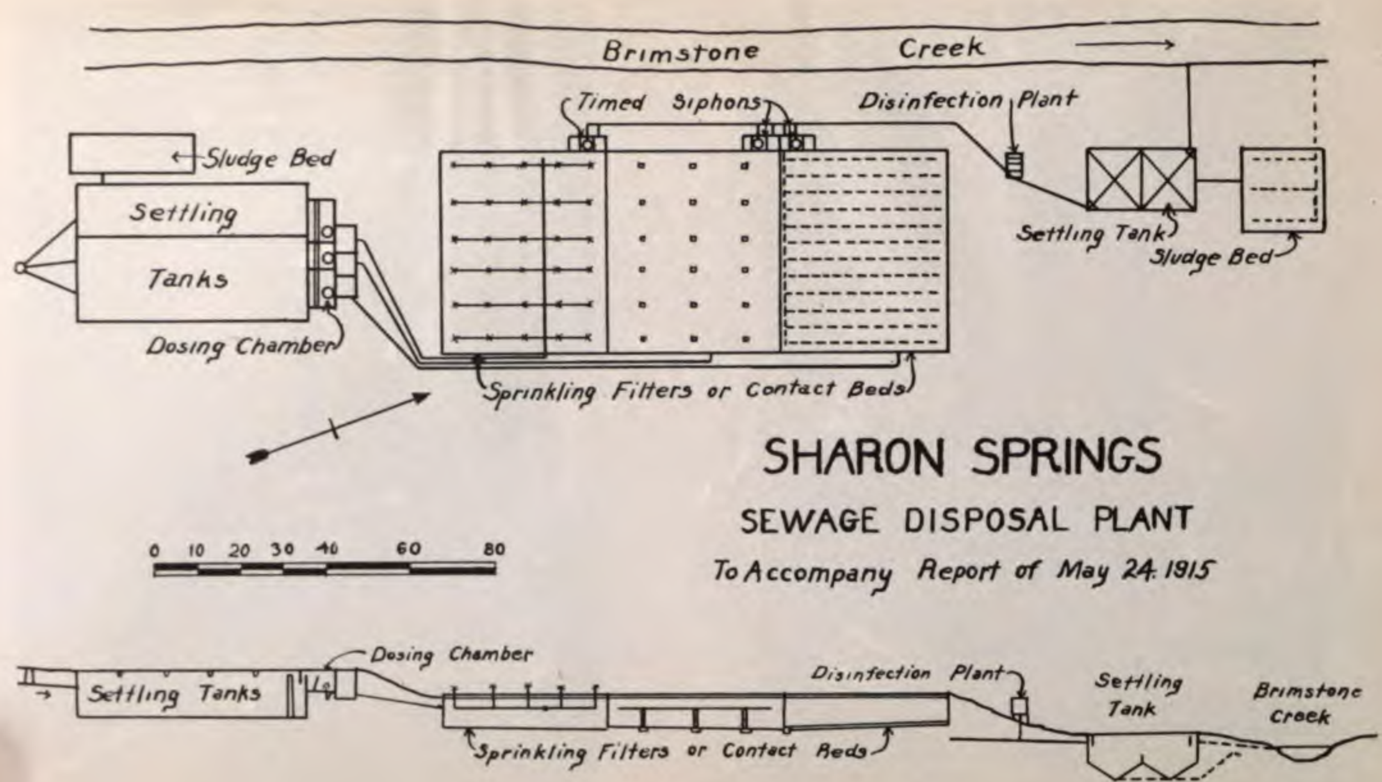
Sewage disposal works.—Two settling tanks, three dosing tanks, three sprinkling filters or contact beds, disinfectant plant, secondary settling tank, and two sludge beds.

Sharon Springs is an incorporated village and is noted largely for the sulphur and magnesia springs which are located in the village. These springs and the baths that are connected with them have been the means of bringing a large summer population to the place. The permanent population has not varied much in recent years, since in 1905 there were 526 inhabitants, in 1910 there were 459, while at the time of the inspection the population was estimated at about 500. The total summer population was estimated to be about 2,500.

The public water supply is obtained from brooks located in the southern part of the village. This is a gravity supply and the water is not filtered before being used. About 80 per cent of the inhabitants are served by this water. No figures on the daily consumption could be obtained since there were no meters or facilities for measuring the consumption.

The sewer system consists of about three miles of sanitary sewers varying in size from 4 inches to 15 inches. About 75 per cent of the inhabitants are served by these sewers, although during the summer a greater number would be served by reason of the hotels being connected to the sewer system.

The approximate daily flow of sewage as measured at the time of inspection was about 156,200 gallons per day. This would correspond to an average flow per capita of about 417 gallons per day. This flow per capita is exceedingly high and it is estimated that probably three-fourths of the flow was due to infiltration of ground water, or leakage into the sewer as it passed under the creek. It is estimated that the summer maximum flow would be about 318,700 gallons, which would correspond to a flow per capita of 160 gallons. This amount is calculated on the assumption that the normal sewage


Brimstone Creek
Timed Siphons
Disinfection Plant
Sludge Bed
Settling Tanks
Dosing Chamber
Sprinkling Filters or Contact Beds
Settling Tank
Sludge Bed
SHARON SPRINGS
SEWAGE DISPOSAL PLANT
To Accompany Report of May 24. 1915
0 10 20 30 40 60 80
Settling Tanks
Dosing Chamber
Sprinkling Filters or Contact Beds
Disinfection Plant
Settling Tank
Brimstone Creek

The small tank has one inlet pipe located about three feet below the surface and at the opposite end of the tank is a sludge baffle similar in design to that of the large tank but located about eight feet from the end of the tank. There are five scum baffles in this tank located about equal distances apart and the last baffle is twelve inches from the end of the tank. The end of this tank also forms a weir over which the sewage is discharged into a dosing chamber.

At the time of the inspection, both tanks were being used as settling tanks and about one-third of their capacity was occupied with sludge or scum. The tanks were emptied about a year previous to the inspection and in the past they have been cleaned of sludge and scum about every two years. On the open bed considerable scum and ice had formed except in those portions adjacent to the inlet pipe and outlet weir. The tanks were being used in parallel and the sewage was entering each tank at the inlet end and was leaving the tanks over the weirs.

Dosing tanks.—There are three dosing chambers of different sizes which are connected in order that the entire quantity of sewage in them may be discharged at each operation of a siphon. In each chamber is an 8-inch alternating siphon which discharges the sewage to its corresponding sprinkling filter or contact bed. In front of each of the siphons is placed a metal screen having one-fourth inch openings. All the screens were badly clogged although the sewage was passing through two of them without much loss of head. These screens are said to be cleaned about once a week in the summer and once or twice a month during the winter. The theoretical amount of sewage discharge at each operation of the siphon would be 3,300 gallons, but due to the clogging of the center screen, the dose amounted to about 2,900 gallons. The small settling tank is supposed to give additional dosing capacity for use in the winter, while the filters are being used as contact beds. The total amount of sewage at each discharge should then be about 12,000 gallons.

At the time of the inspection only two siphons were operating, which caused practically all of the sewage to be discharged onto the two beds furthest from the settling tanks. Both settling tanks were being used as such and no additional dosing capacity was being obtained from the small tank.

Sprinkling filters or contact beds.—There are three sprinkling filters which have their discharge arranged so that the filters may be used as contact beds. These filters are 39½ by 47½ feet in plan. This gives an area for each bed of 1,887 square feet or .13 of an acre for the three beds. The floors of the filters are constructed of four-inch reinforced concrete and the sides and partition walls are of plain concrete 6 inches thick. The filtering material consists of about 7 feet of broken stone varying in size from about ¾ to 3 inches.

The distribution system consists of a line of 8-inch cast iron pipe leading from the dosing chamber to and across each filter unit. Six 6-inch cast iron laterals 8 feet between centers are connected to the 8-inch main on each bed. These laterals are supported about 2 feet below the surface of the stone on 10-inch square concrete columns which extend down to spread footings below the concrete floors. Three-inch risers 8 feet apart extend from the lateral up to about 1½ feet above the surface of the stone. This gives a spacing of 8 feet between the nozzles, which are square spray Taylor nozzles. During the period of contact operation, the nozzles are removed and wooden boxes about 10 inches square and 2 feet high are placed over the risers.

The underdrains consist of lines of half-round, 6-inch slotted tile pipe 4 feet between centers laid on the floor and drain to the main collector which is adjacent to the partition walls. These main collectors are 1 foot by 6 inches in size and lead to the drainage chambers from where the sewage passes to the final settling tank or to the time siphon in case the filters are being used as contact beds.

When the filters are used as contact beds only about 3 feet of the bottom of the filter is used. Assuming the voids as 40 per cent, the capacity of one would be about 16,000 gallons. Adjacent to each of the filters is an 8-inch timed siphon chamber.

When the filters are used as sprinkling filters, the timed siphons are by-passed and out of use, while during the period of contact operation, the effluent from the beds is first passed through the siphons before it flows to the secondary settling tank.

With the amount of sewage flowing as found on the day of inspection, if distributed over the entire area as a sprinkling filter, the rate would be 1,200,000 gallons per day or 172,000 gallons per acre per foot in depth per day. With the maximum estimated flow of 348,700 gallons per day, the rate would be 2,680,000 per acre per day or 268,000 gallons per acre per foot in depth per day.

With the filters in use as contact beds under the condition of flow as found during the inspection, the rate would be equivalent to 1,200,000 gallons per acre per day or 400,000 gallons per acre per foot in depth per day. At the time of the inspection, however, only two of the beds were being used on account of the inoperative condition of one of the dosing siphons. This would give rates 50 per cent higher than if the three beds were being used.

At the time of the inspection, the middle bed was being operated as a contact bed while the third bed was acting as a strainer with the effluent flowing out through the timed siphon whenever the tank effluent was being discharged onto the bed. The draining valve of the distributing pipes on the third bed was nearly wide open and, therefore, a greater part of the sewage flowed through this valve and thence to the underdrain. The timed siphon of the middle bed was adjusted so that the siphon started to discharge the sewage after a contact period of ten minutes. The bed was emptied in forty-three minutes after the starting of the discharge.

Disinfection.—A temporary disinfecting plant has been constructed which consists of a wooden box about 3 feet deep, 3 feet wide, and 6 feet long. This box is divided into several compartments and water from the brook is lead to the first compartment from whence it overflows into each of the other compartments and finally is discharged into the sewer leading from the sprinkling filter to the secondary settling tank.

About half a pail of hypochlorite of lime is placed in the first compartment every two or three days during the summer. Last year about 300 pounds were used, which would probably average three pounds a day or ten pounds of hypochlorite of lime per million gallons of sewage, which amount to .4 parts of available chlorine per million parts of effluent. The permit issued by this Department called for not less than seventy-five pounds of hypochlorite of lime per million gallons of sewage and also that detailed plans of the disinfecting plant be submitted to this Department for approval. These plans were never submitted and a temporary plant was built for summer use. The disinfecting plant was not being used at the time of the inspection.

Secondary settling tank.—This tank is constructed of concrete and 23½ feet by 12 feet in plan. The bottom of the tank is divided into two hopper-shaped compartments, which are from 5½ to 9½ feet below the surface of the sewage. In the bottom of each hopper is a 6-inch pipe through which the sludge is discharged into the sludge beds. The sewage enters the tank through a 12-inch pipe in one corner and is discharged through a similar pipe in the opposite corner of the tanks. Two-inch by 24-inch baffle and scum boards are placed about 12 inches in front of the influent and effluent pipes.

This tank has a capacity of about 12,500 gallons and with the amount of sewage flowing as found at the time of the inspection, the average theoretical detention period would be about two hours while, with the estimated summer flow, the detention period would be fifty minutes. These periods are not actually obtained since part of the tank is occupied with sludge and also on account of the intermittent flow from the filters, when operated as contact beds, but since the function of this tank is to settle sprinkling filter effluent, its capacity appears to be ample when cleaned of sludge.

Sludge disposal.—There are two sludge beds, one 30 feet by 10 feet in plan which is located between the river and the settling tanks and the other bed, 20 feet square, is located north of the secondary settling tank. The 30 by 10 feet sludge bed was built with the settling tanks and receives the sewage from the tanks. The sludge from these tanks is discharged onto this bed about

every two years. The 20 by 20 feet sludge bed was built at the time of the construction of the sprinkling filter and receives sludge from the secondary settling tank. The sludge from this tank is discharged on the bed about four times a year.

Cost and maintenance of disposal works.—The original settling tanks cost about \$4,000 and the sprinkling filters, secondary tank, etc., cost about \$11,000. These prices are exclusive of the cost of the land.

The Superintendent of Sewers has charge of the sewers and the sewage disposal plant. The yearly cost of the operation is about \$60 and includes the cost of the disinfectant.

Efficiency of plant as determined by chemical analyses

In order to determine the efficiency of the disposal plant to properly treat the sewage contributed to it and also as a test of the efficiency of the different units comprising the plant, analyses were made of the sewage, of the different effluents, and of the creek water into which the effluent was discharged. The report of these analyses, which includes the temperature of the samples, gives the result of the tests for settling, turbidity, oxygen consumed, dissolved oxygen, nitrates, chlorine, putrescibility, and bacteria and the results are shown in the following table:

ANALYSES MADE ON MARCH 18–19, 1915

	Date	Time	Temperature	Imhoff cone c. c. in 1 hour	Turbidity	Oxygen consumed, 10 min boiling	Dissolved Oxygen		Nitrates	Chlorine	Putrescibility, days	Bacteria 48 hours 20 C.
							Parts	Per cent of saturation				
Raw sewage	**3/18/15**	**2:00 P. M.**	**39**	**1.0**	**170**	**42**	**4.8**	**37**	......	**14**	**3¼**	**21,000**
Tank effluent	3/18/15	2:00 P. M.	39	Tr.	35	37	4.5	34	......	14	3¾	78,000
Contact bed effluent	3/18/15	4:00 P. M.	38	...	45	54	3.3	25	0.4	14	3¼	25,000
	3/19/15	10:15 A. M.	40	...	...	...	2.3	18	0.3	...	...	.....
Final effluent	3/18/15	4:00 P. M.	38	...	35	18	3.4	26	......	14	4⅞	.....
Stream above	3/19/15	10:00 A. M.	38	...	Cl.	4.7	6.2	47	......	3	Over 20	90
Stream below	3/19/15	10:00 A. M.	38	...	Cl.	10.4	5.8	43	......	4½	Over 20	2,600

While the results of but one set of analyses may not represent average results of operation of the plant over a long time, they do, nevertheless, show the condition at the time of the inspection, which may be stated as follows:

The raw sewage as received at the plant was about one-fourth of the average strength of domestic sewage of the day flow of a municipality of the same size. This is shown by the tests for settling, turbidity, chlorine, putrescibility, and the bacterial count. The 42 parts of oxygen consumed is undoubtedly partially due to the H_2S which is found in the local sulphur springs. This low strength of sewage is also verified by the high flow per capita of 417 gallons. The weakness of this sewage is probably due to the infiltration of ground water and also to leakage into the sewer as it passes under the brook. The high dissolved oxygen and low temperature are also probably due to this excess of ground water.

The settling and turbidity tests of the tank effluent showed a removal of a good percentage of the suspended matter. The oxygen consumed test showed only a small reduction from that of the raw sewage and the H_2S is probably a factor in this test also. The high dissolved oxygen and putrescibility test of 3¾ days are probably due to the cold weather prevailing at the time of the test which would retard the bacterial growth. The chlorine test gave the same result as that of the raw sewage. The bacterial count, while higher

than in the raw sewage, still is low for an effluent of a settling tank which gives a theoretical detention of twelve hours.

In the tests of the contact bed effluent, the principal test was made of the strained effluent since that was the effluent being discharged at the time of testing. On the next morning, tests for dissolved oxygen and nitrates were made of a contact effluent to determine the difference in the nitrification.

In reference to the test of the strained effluent it will be seen that the turbidity and oxygen consumed increased and this is probably due to a small amount of suspended matter which was being washed out of the filters during the time of testing and also to the H_2S present in the effluent. The 3.3 parts of dissolved oxygen as compared with the 4.5 in the tank effluent showed the removal of oxygen by the bacterial action as the sewage flowed through the bed. The 0.4 parts of nitrates is very low and shows the absence of nitrification which should have been performed by the contact beds. The chlorine result of 14 parts was the same as that found in the raw sewage and tank effluent. In the putrescibility test, a stability of 3¾ days was obtained which is the same as that given by the tank effluent. In the bacterial test a lower count was found than that of the tank effluent although it was greater than the count in the raw sewage.

In the tests of the contact effluent taken on March 19, it will be seen that the dissolved oxygen gave 2.3 parts and the nitrates 0.3 parts. These results are lower than those obtained by the straining action and is due to the long time that some of the sewage remained in the bed.

Considering next the final effluent, which is the contact bed effluent after passing through the secondary settling basin, it will be seen that the turbidity was reduced from 45 to 35 parts and the oxygen consumed from 54 to 18 parts. These reductions are probably due to the removal by settlement of suspended matter. The 3.4 parts of dissolved oxygen and 14 parts of chlorine are practically the same as were found in the effluent before passing through the basin. In the putrescibility test, the stability of 4¾ days as compared with the 3¾ days of the contact bed effluent is undoubtedly due to the removal of part of the suspended matter.

The water of the creek above the discharge of the effluent was clear and nonputrescible. It had 4.7 parts of oxygen consumed, 6.2 parts of dissolved oxygen, and 3 parts of chlorine. In the bacterial test, a count of only ninety was obtained. These results show comparatively little or no pollution of the waters above the discharge of the effluent. About three-quarters of a mile above the disposal plant are located several sulphur springs and for about one-fourth mile below the springs the bed of the brook is covered with a dense growth of sulphur bacteria or fungi. Immediately above the disposal plant, however, this growth has not formed.

Referring lastly to the creek below the point of discharge of the effluent, it will be seen that at the time of the inspection the dilution was sufficient to render the water clear and nonputrescible. The oxygen consumed, however, increased from 4.7 to 10.4 parts and the chlorine from 3 to 4½ parts. These tests plainly indicated the presence of the effluent as also did the bacteria count which increased from 90 to 2,600.

Due to the high flow in the creek and to the cold weather prevailing at the time of the inspection, the bed of the brook below the discharge of the effluent did not appear objectionable to the sight or smell since no growths due to the presence of the effluent could be detected on the bed of the creek and no unpleasant odors were noticed. This high flow, however, would not continue for all of the winter and certainly not during the summer and, at times when the flow amounts to 2 or 3 cubic feet per second, the effluent if discharged in the condition as found during the inspection would be sure to cause a nuisance.

Summary and conclusions

As a result then of the investigation of this plant and after careful consideration of the condition of operation and of the results of the analyses of

samples from the various parts of the plant, the following summary and conclusions are presented:

1. The excessive amount of ground or creek water entering the sewers causes excessive rates of treatment by the plant when the filters are used as contact beds, although the organic matter is not necessarily increased.

2. The settling tanks were about one-third full of sludge and scum and were giving a good removal of suspended matter. It is probable, if more of their capacity was occupied with sludge and during summer weather when the bacterial action was increased, that considerable suspended matter would be carried out with the effluent.

3. Only two of the siphons were operating and the additional dosing capacity of the small settling tank was not being used.

4. The operation of the dosing apparatus in giving doses smaller than the capacity of a contact bed results in the other beds each receiving a dose before the first bed receives a second dose. This causes some of the sewage to stand in the beds for several hours before the dicharge level is reached.

5. Only two of the beds were being used and one of these as a strainer since the tank effluent discharged on the bed passed directly through the bed without any period of contact. The valve for draining the distributing system of the bed which was being used as a strainer was nearly wide open and most of the sewage passed through the valve and thence to the underdrain.

6. The plans for the disinfecting apparatus were not submitted for approval as required by the permit nor was any bleach being used and even in summer the amounts used were far below the quantity required by the permit.

Recommendations

1. That an endeavor be made to locate the district from which the excessive ground water reaches the sewer and this portion of the sewer be made tight, if possible.

2. That sludge in the settling tanks be removed at intervals so that not more than one-third of the capacity of the tanks, at any time, shall be occupied with sludge and scum.

3. That all three of the siphons be placed in an operating condition and the screens be maintained in an effective manner.

4. That the filters be used as contact beds only during the coldest weather.

5. That when the filters are being used as contact beds, the extra dosing capacity of the small tank be used and that the total amount of one dose be made sufficient to fill each contact bed to its discharge height.

6. That the plans for the hypochlorite plant be submitted as required by the permit.

7. That not less than seventy-five pounds of bleach per million gallons of sewage be used except during the summer at which time not less than 125 pounds per million gallons be used.

Respectfully submitted,

THEODORE HORTON,
Chief Engineer

ALBANY, N. Y., *May* 24, 1915

SKANEATELES

HERMANN M. BIGGS, M.D., *State Commissioner of Health:*

I beg to submit the following report on an investigation of the sewage disposal plant of the village of Skaneateles, Onondaga county, made on December 10, 1914. This investigation was made by Mr. Morton F. Sanborn, assistant engineer, in connection with the general investigation of sewage disposal plants

in the State now being carried on. A previous investigation was made of the disposal plant in 1907, the report of which is published on page 818 of the 28th annual report of the State Department of Health.

Location and general description

Location.— Situated 16 miles southwest of Syracuse. North end of Skaneateles lake on Skaneateles creek. On the Skaneateles R. R. and the Auburn & Syracuse Electric Railway.

Water supply.— Municipal from Skaneateles lake.

Sewer system.— Ten miles of sanitary sewers, 6 inches to 15 inches in diameter.

Sewage disposal works.—Grit chamber, settling chamber and sludge bed.

Skaneateles is an incorporated village and is chiefly a residential community. There has been a slight increase in the number of inhabitants in the last few years; since there were 1,584 in 1905 and 1,615 in the year 1910 and at the time of inspection it was estimated that the number of inhabitants was about 1,700.

The public water supply of the village of Skaneateles is obtained from Skaneateles lake and the water is pumped to the reservoir and used without filtration. Practically all of the inhabitants are served by this water system.

The sewer system consists of about 10 miles of sanitary sewers varying in size from 6 inches to 15 inches. About 1,360 inhabitants equivalent to about 80 per cent of the total population, are served by the sewer system and sewage disposal works. The approximate daily flow of sewage reaching the disposal plant on the day of inspection was about 166,400 gallons per day as measured by the current meter in the main sewer. This amount of sewage is equivalent to a per capita flow per day of about 122 gallons and probably a small amount of ground water and no trade wastes are received with the sewage at the disposal plant.

The disposal works were designed by Mr. H. B. Cleveland, civil engineer of Albany, and the plans were approved by this Department on July 3, 1903. The plant was completed and put in operation in 1904.

The effluent from the disposal works flows into Skaneateles creek about one-half mile below Skaneateles lake and this creek is a tributary of Seneca river and is also used as a feeder for the Erie canal. The creek has a watershed above the disposal plant of about 74 square miles. The flow in the river at the time of inspection amounted to about 107 cu. ft. per second which is equivalent to 1.45 cu. ft. per second per square mile. This flow is also equal to about 79 cu. ft. per thousand population contributing sewage. The lake waters are stored, principally to feed the canal system, in such a manner as to maintain for the greater part of the year the flow observed at the time of the inspection. If the storage in the lake becomes depleted the flow is reduced during part of the winter to about one-seventh of the usual flow. The lake water is used for the public water supply of the city of Syracuse and the village of Skaneateles and below the village the creek water is not used for public water supply nor does any general system of sewerage or sewage disposal works discharge into the creek.

Description of sewage disposal works

Site.—The disposal plant is located on the left bank of Skaneateles creek about one-half mile below the lake and is about 300 feet from the nearest road on which there are several houses.

Head house.—The head house is of brick with a timber roof and is 16 feet by 22 feet in plan. In this house are located the piping and valves which allow the tank to be by-passed during the cleaning of the tank, and also the grit and effluent chambers and a 4-inch centrifugal pump for the pumping of sludge.

Grit chamber.—The grit chamber is 10½ feet by 4 feet in plan and about 6 feet deep. This gives a capacity of 1,890 gallons and a detention period of

16 minutes with the amount of sewage flowing as found at the time of inspection. Since the disposal plant receives only domestic sewage very little grit is found in the chamber and at the time of inspection the chamber was practically filled with sludge and scum.

Settling tank.—The settling tank is a concrete structure about 30 feet wide and 68 feet long and 6¼ feet deep. The tank is divided by a brick wall 54 feet long so as to form a continuous tank 130 feet long and 14 feet wide. This gives a capacity of about 85,300 gallons and a detention period of about 12 hours with the amount of sewage flowing as found at times of the inspections.

Weirs 7 feet long are placed at the influent and effluent ends of the tank and the effluent weir is 1¼ inches lower than the influent weir. About 8 inches distant from the weirs are baffles extending from about 6 inches above the sewage down to about mid-depth of the tank. Sludge pipes are provided for the removal of the sludge to the sludge bed. The effluent from the tank flows through the effluent chamber and pipe directly to the river.

At the time of the inspection the tank was nearly filled with scum and sludge which resulted in giving a very short detention period to the sewage.

Sludge disposal.— The sludge bed is 17 feet by 100 feet and 2 feet deep and has an area of 1,700 square feet. The embankment along the creek side of the bed consists of gravel through which the liquid from the sludge is supposed to drain to a gutter leading to the creek. In the head house is a 4-inch centrifugal pump which pumps the sludge from the grit chamber, settling tank and effluent chamber and discharges it on the sludge bed.

Cost and operation of plant.—The disposal plant and sewer system were built jointly by the village of Skaneateles and the city of Syracuse in order to protect the public water supply of the city from pollution. The disposal plant cost about $6,000.

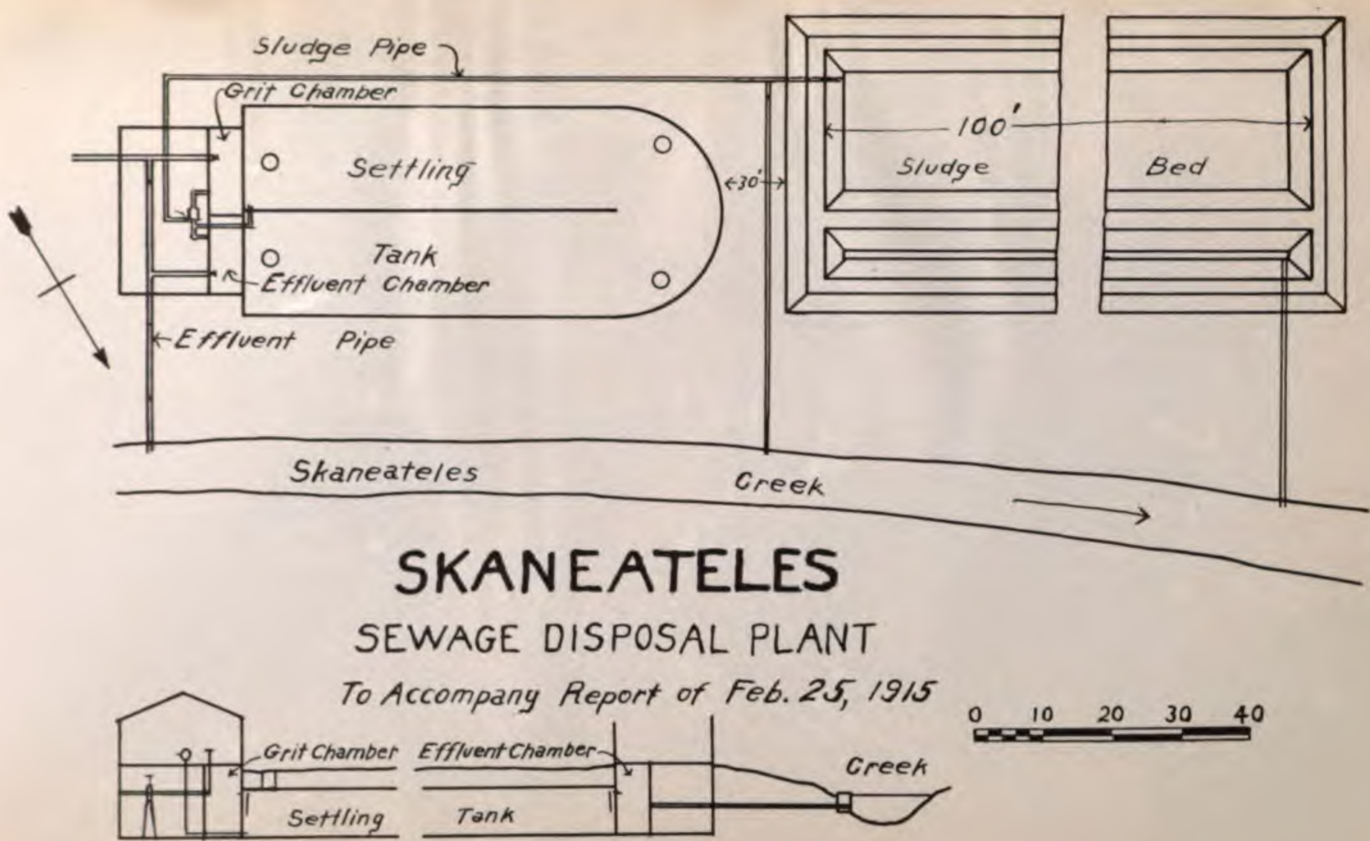
At the time of inspection the plant apparently was not being looked after as the village clerk stated that the city was supposed to maintain the plant, while the water department of the city claimed that they paid the village to maintain it.

Efficiency of plant as determined by chemical analyses

In order to determine the efficiency of the disposal plant to properly treat the sewage contributed to it and also as a test of the efficiency of the plant, analyses were made of the sewage, of the effluent of the plant and of the creek water. These analyses included the temperature of the sample and comprise tests for settling solids, turbidity, oxygen consumed, dissolved oxygen, chlorine and putrescibility and the results are shown in the following table:

ANALYSES MADE ON DECEMBER 19, 1914

	Temperature	Imhoff cone c. c. in 1 hour	Parts Per Million					Putrescibility, days
			Turbidity	Oxygen consumed, 10 min. boiling	Dissolved Oxygen		Chlorine	
					Parts	Per cent of saturation		
Raw sewage	47°	3.0	120	31	1.4	12	44	....
Tank effluent	47°	0.15	50	44	1.4	12	64	1
Stream above	39°	....	....	2.8	5.8	44	5	Over 20
Stream below	39°	....	....	3.0	5.7	43	6	Over 20



SKANEATELES

SEWAGE DISPOSAL PLANT

To Accompany Report of Feb. 25, 1915

Recommendations

In view of the results of this investigation, I would recommend that since the plant was installed by the village of Skaneateles and the village authorities be required to have the sludge and scum removed from the grit chamber and the settling tank and that this cleaning be resorted to from time to time as may be required to prevent any accumulation of sludge and scum to an extent greater than one-third the capacity of the tank.

Respectfully submitted,

THEODORE HORTON,
Chief Engineer

ALBANY, N. Y., *February* 26, 1915

WESTFIELD (Welch Grape Juice Co.)

HERMANN M. BIGGS, M.D., *State Commissioner of Health:*

I beg to submit the following report on an investigation of the disposal plant for the treatment of the trade wastes from the Welch Grape Juice Co. factory at Westfield, Chautauqua county, made on August 4, 1914 and November 9, 1914. This investigation was made by Mr. Morton F. Sanborn, assistant engineer, in connection with the general investigation of disposal plants in the State now being carried on and with special reference to complants received in regard to a nuisance caused by the discharge of the wastes into Chautauqua creek.

Location and general description

Location.— Situated in the village of Westfield; south of Lake Shore and Michigan Southern railroad, 600 feet east of Chautauqua creek

Employes.— 60 to 100.

Water supply.— From municipal supply of Westfield

Sewers.—About 200 feet of 4-inch iron pipe leading from factory to disposal plant

Disposal works.—Settling tank, screen and two gravel filters.

The Welch Grape Juice factory is located in Westfield on the south side of the New York, Chicago and St. Louis R. R. and the property extends from the highway to the creek and is on both sides of the railroad. The chief occupation carried on in the surrounding country consist of the raising of grapes which are either shipped direct to New York city or converted into grape juice at this factory or at the factory of Armour & Co., located nearby.

The pressing of the grapes takes place in the fall and usually lasts for three or four weeks. This period is followed by a general cleaning up, washing the pressing cloths, etc., which lasts for two or three weeks. During the rest of the year the work consists chiefly of rebottling, for distribution, the grape juice stored in the 5-gallon bottles. The average daily amount of water ordinarily used is about 60,000 gallons, although during the pressing and general cleaning up season the amount of water used will be two or three times as much.

The wastes during the pressing season and general cleaning up in the fall, contains considerable organic matter due to the seeds, skins, pumice and washings of the pressing cloths and washings of the floors. The rest of the year the wastes consist chiefly of the sediment which has settled in the 5-gallon bottles, which are emptied when the grape juice is rebottled into smaller bottles, and the washings of the floor and bottles. Most of the skins, seeds and pumice are separated from the liquid wastes and spread out on land in rear of the factory to dry.

Complaints have been made from time to time in regard to the discharge of wastes from this factory into Chautauqua creek and on October 30, 1912 an

inspection of the conditions existing at that time was made by the Department, which showed clearly the insanitary condition caused by the discharge of the untreated wastes into the creek.

Since then the wastes were for a time discharged into the village sewer system and through the village disposal works consisting of settling tanks and contact filters. During the fall of 1913 it was found that the combined sewage and trade wastes flow was apparently too much of a burden for the village disposal plant and the village authorities ordered the two grape juice companies to discontinue discharging their trade wastes into the village sewer system.

As a result of this order the Welch Grape Juice Co. built the present disposal plant to treat the wastes before discharging them into the creek. This plant is located chiefly in the field across the track from the factory and the effluent flows over the ground and discharges into Chautauqua creek about 500 feet from the plant.

The disposal plant was designed by Mr. C. C. Hill, civil engineer, of North East, Pa., and was constructed by the company during the Fall of 1914 and was in use during the pressing season of that year. Plans for the plant were not submitted to this Department for approval and its construction and use constitute a violation of the Public Health Law.

At the time of the first inspection on August 4, 1914, it was stated at the factory that the wastes during the pressing season were discharged into the village sewer system and that during the remainder of the year the wastes were discharged directly into the creek. At the time of the last visit on November 9, 1914 the disposal plant had been constructed and was in use treating all of the wastes from the factory consisting at that time chiefly of wastes from the general cleaning up operation following the pressing season.

Chautauqua creek above the point of discharge of the disposal plant has a drainage area of about 33½ square miles consisting mostly of hilly country with the low lands under cultivation. The flow of the creek at the time of the first visit was about 2 cu. ft. per second. This flow would be equal to about .06 cu. ft. per second per square mile. The average wastes from the factory as stated above is 60,000 gallons per day while during the pressing season the flow may be two or three times as much.

The wastes would then, ordinarily, be diluted with about twenty times their volume of creek water during periods of low flow, whereas, during periods of maximum waste discharge the dilution would be only about one third as great.

Description of sewage disposal works

The disposal works consist of a settling tank, a screen and two gravel filters. The settling tanks and screen are located in the factory while the gravel filters are in the open field across the track from the factory.

The settling tank is small, holding from two or three hours flow of the wastes. A fine screen is provided to remove any pumice or skins that would be carried out with the effluents. A laborer was supposed to keep the tank and screen in working condition but the plant failed to operate satisfactorily on account of the large amount of suspended matter and the rapid clogging of the screen. The inefficiency of the tank and screen was plainly seen by the large amount of skins, seeds and pumice covering the filter beds and on the ground over which the effluent from the filters flowed.

There are two filters about 50 feet by 95 feet which are filled with about a foot of sand and gravel. The beds have a total area of about 9,500 square feet or .22 of an acre. With the average amount of wastes of 60,000 gallons per day the rate of treatment is equivalent to about 273,000 gallons per acre per day and with the maximum amount of wastes the rates would be about 819,000 gallons per acre per day. A concrete wall about 8 inches high surrounds and separates the filters. Along the southerly side of the filters is a distributing trough one side of which forms a weir over which the wastes flow to the filters. Either one or both filters may be used as desired. The

filters are underdrained and the effluent is discharged through a pipe along the north side and between the beds.

The wastes are conveyed from the factory to the filters through a 4-inch iron pipe. At a bend in this pipe between the factory and the filters there is an outlet kept closed by means of a plug and it was evident from the condition of the ground near by that the plug had been removed at various times to allow the wastes to flow to the creek without passing through the filters. The greater portion of the surface of the filters was covered with a scum and from the appearance of the beds the surface has, at times, been clogged and as a result the wastes have passed over the walls of the filters and flowed to the brook and creek.

At the time of the first inspection on August 4, 1914, a chemical analysis was made of the wastes that were discharged from the factory at that time. The wastes then consisted of the sediment from the bottles and the washings from bottles, utensils and floors, etc. The test for oxygen consumed, 10 minutes boiling, gave 76 parts per million and in the putrescibility test showed stability for 3½ days.

At the time of the second inspection more analyses were made to determine the character of the wastes. At this time also a full test was made of the plant to determine its efficiency and the value of sedimentation as compared with chemical precipitation.

ANALYSES MADE ON NOVEMBER 9, 1914

	PARTS PER MILLION		Imhoff cone c. c. in one hour
	Turbidity	Oxygen consumed 10 minutes boiling	
Raw wastes as received at plant	900	....	1.1
Raw wastes as received at plant — Clear portion after two hours in Imhoff cone	....	540	....
Raw wastes as received at plant — Filtrate through filter paper	....	420	....
Effluent of filter at disposal plant	700	190	0.07
Clear portion of raw wastes as received at plant after two hours settling in Imhoff cone and after treatment by chemical precipitation	Clear	98 to 104	......

IMHOFF CONE TEST STARTED 10:30 A. M. *Cubic Centimeters of Sludge from 1,000 c.c. of Wastes.*	Raw wastes	Effluent filter trace
10:45 A. M.	0.5	0.05
11:00 A. M.	0.8	0.06
11:30 A. M.	1.1	0.07
12:00 M.	1.1	0.08
1:00 P. M.	1.2	0.10

While the character and volume of flow of the average trade wastes from this grape juice factory at the time of this test may not correspond to the average for the year the results of this test do, nevertheless, show clearly the character of the wastes and the efficiency of the disposal plant at the time of this test.

The wastes received at the disposal plant on November 9, 1914, probably represent the approximate condition of the wastes during the pressing season

and the general cleaning immediately following. The turbidity of the raw wastes amounted to 900 parts, the greater part of which was due to fine suspended matter that did not readily settle. In the Imhoff cone test 1.1 cubic centimeters of readily suspended matter was obtained in one hour. The oxygen consumed test of the supernatant portion of the wastes after they had been standing two hours, gave 540 parts. This indicated a strength of about five times the strength of the average day flow of domestic sewage. The same wastes after passing through filter paper gave 420 parts which showed a reduction of 22 per cent in oxygen consumed, obtained by passing the wastes through the filter paper. This test indicated that the greater part of the organic matter was in solution or was in a very fine suspended state and was not removed by settlement or by filtration through filter paper.

The effluent of the filters had 700 parts of turbidity as compared with the 900 parts of the raw wastes and represents a reduction of about 22 per cent in the turbility. The Imhoff cone test gave 0.07 cubic centimeters of sludge and indicated the removal of about 94 per cent of the readily settling matter contained in the raw wastes. In the oxygen consumed test 100 parts were found which showed a reduction of 65 per cent from that found in the raw wastes.

It is evident, therefore, that although the effluent from the filters as compared with the raw wastes showed a considerable reduction of readily settling matter, a removal of 22 per cent. of the turbidity and a reduction of 65 per cent. of the total organic matter as shown by oxygen consumed figures, the large amount of organic matter remaining undoubtedly renders the effluent unstable and shows clearly that the filters are inadequate to properly purify these wastes.

The condition of the ground over which the effluent flows to the creek and over which some of the raw wastes have apparently flowed also plainly indicated the offensive character of the wastes if not properly purified. This was evidenced by the pools of black foul smelling wastes at various places along the line of flow to the creek.

In view of the inadequacy of the plant to properly treat the wastes from this factory tests were made of the settled raw wastes to determine if the process of chemical precipitation could be used in the treatment of the wastes and its efficiency as compared with plain sedimentation. The tests were not made with a view of determining the amounts necessary to treat the wastes but chiefly to determine if a good percentage of clarification and removal of organic matter could be obtained. The raw wastes after settling two hours in the Imhoff cone were used in these tests. In one of the tests made 30.5 grains of lime and 138 grains of copperas per gallon mixed together in the wastes which had been settled gave a reduction in oxygen consumed from 540 parts in the raw wastes to 98 parts in the treated wastes and represented a reduction of organic matter of 82 per cent. The sugar in the wastes which is not removed by chemical precipitation probably accounted for a large part of the 98 parts of oxygen consumed remaining in the wastes. In another test 20.3 grains of lime and 69 grains of alum per gallon gave 104 parts of oxygen consumed in the treated wastes and represented a reduction of 81 per cent of the organic matter. Both tests gave a clear effluent which had a very slight amount of color. These amounts of chemicals are greater than are ordinarily used in chemical precipitation works and it is probable that the amounts could be considerably reduced and still give a satisfactory effluent. With good settling and screening of the wastes at all times of the year a smaller amount of chemicals could probably be used. For the weaker wastes which occur during the greater part of the year the amount necessary would probably be from one-third to one-tenth of the amount necessary during the pressing and cleaning seasons.

Summary and conclusions

As a result, then of the investigation of this plant and after careful consideration of the conditions of operation of the plant and the results of analyses of samples of the wastes, of the effluent of the plant and of certain

studies and tests made with respect to chemical precipitation the following conclusions have been reached:

1. The settling tank and screens are not properly cleaned and operated and were not, therefore, performing the valuable service or removing the large amount of suspended matter in the wastes and thereby protecting the filters.

2. The sand and gravel filters are not of a proper type, design or capacity to treat the wastes from the factory with its excessive amount of organic matter, a large part of which is in solution.

3. As a result of these omissions and defects the partially purified wastes are discharged upon the ground and into Chautauqua creek in such a manner and under such conditions as to produce an offensive and objectionable nuisance.

4. The construction and operation of the disposal plant is a violation of the Public Health Law as the plans for the same were not approved by this Department.

5. If filters are to be used in the treatment of these wastes efficient settling and screening of the wastes should be provided in order that as much suspended matter as practicable will be removed from the wastes and the filter thus protected as much as possible against clogging. Such settling tanks should be cleaned at frequent intervals and otherwise properly operated and maintained.

6. Tests indicate that chemical precipitation of the wastes is more effective than plain sedimentation and that this treatment whether alone or with filtration might prove to be the more satisfactory solution of the problem of wastes disposal at this factory.

7. Owing to the large amount of sugar present in the wastes and the fermentative character it is not possible to state at this time whether biological treatment in filters would be a practicable and effective method of treatment.

Recommendations

In view of the insufficient and unsatisfactory condition and results of operation of the plant, the construction of which was unauthorized by this Department and the nuisance resulting from the discharge of insufficiently purified effluent into Chautauqua creek, I recommend that the Welch Grape Juice Co. be required to proceed at once to alter, reconstruct or otherwise install a waste disposal plant of such type and design as will produce an effluent which will remove the objectionable conditions that now exist from the operation of the present plant. The question as to what type of plant shall be adopted is one that will, no doubt, require study of a competent expert in the field and I recommend that before the Welch Grape Juice Co. install a plant they so employ such an expert to study this problem and advise them, plans for the plant to be submitted for approval.

Respectfully submitted,

THEODORE HORTON,
Chief Engineer

ALBANY, N. Y., *April* 13, 1915

WESTFIELD (Armour & Co.)

HERMANN M. BIGGS, M.D., *State Commissioner of Health:*

I beg to submit the following report on an investigation of the disposal plant for the treatment of the trade wastes from Armour & Co. grape juice factory at Westfield, Chautauqua county, made on August 4, and November 9, 1914. This investigation was made by Mr. Morton F. Sanborn, assistant engineer in connection with the general investigation of disposal plants in the State now being carried on and with special reference to complaints received in regard to the nuisance caused by the discharge of the wastes into Chautauqua creek.

Location and general description

Location.— Situated in the village of Westfield. North of New York, Chicago and St. Louis railroad. About 1,600 feet east of Chautauqua creek

Employes.— Twenty to forty.

Water supply.— From municipal supply of Westfield

Sewers.— About 2,000 feet of 8-inch pipe leading from the factory to the disposal plant

Disposal works.— Pumping manhole and subsurface disposal area.

The Armour & Co. Grape Juice factory is located in the northern part of Westfield on the north side of the New York, Chicago and St. Louis R. R. and on the east side of Franklin street. The occupation of the surrounding country is devoted largely to the raising of grapes which are either shipped direct to New York City or converted into grape juice at this factory or at the factory of the Welch Grape Juice Co. located nearby.

During the fall for about two or three weeks the principal work at the factory consists of the pressing of grapes and the one or two weeks following is the usual cleaning up time for washing of the pressing cloths, etc. During the remainder of the year the work at the factory consists chiefly of rebottling for distribution the grape juice which has been stored in the five-gallon bottles. The average daily water consumption at the factory is about 33,000 gallons, although during the fall pressing and general cleaning-up season the amount of water used may be two or three times as great.

During the pressing and general cleaning-up in the fall the wastes contain considerable organic matter due to the seeds, skins, pumice and washings of the pressing cloths and washings of the floors. During the remainder of the year the wastes consist chiefly of the sediment that has settled in the five-gallon bottles, which are emptied when the grape juice is rebottled into smaller bottles, and also the washings of the floors and bottles. Most of the skins, seeds and pumice removed from the pressing operations are separated from the liquid wastes and spread out in the rear of the factory to dry.

Complaints have been made from time to time in the past in regard to the discharge of wastes from this factory into one of the village brooks. On May 6, 1914, an inspection of the conditions existing at that time was made by the Department which showed clearly the insanitary conditions caused by the discharge of the untreated wastes into the brook. Since then the wastes were for a time, discharged into the village sewer system and passed through the village disposal works which consisted of settling tanks and contact filters. It was found that the combined sewage and the trade wastes from the two grape juice factories were apparently too much of a burden for the sewage disposal plant and, therefore, the village authorities ordered these two companies to discontinue discharging their trade wastes into the village sewer system.

As a result of this order Armour & Co. built the present disposal plant to treat the trade wastes before they were discharged into Chautauqua creek. The pumping chamber is located adjacent to the factory while the disposal field is located on the east bank of the Chautauqua creek and immediately south of the N. Y., C. & St. L. R. R.

The disposal plant was designed by Mr C. C. Hill, civil engineer of North East, Pa., and was constructed by the company during the fall of 1914 and was in use during the pressing season of that year. Plans for the plant were not submitted to this Department for approval and its construction and use constitute a violation of the Public Health Law.

At the time of the first inspection on August 4, 1914, it was stated at the factory that the wastes were being discharged into the village sewer system. At that time the sewer line leading from the factory to the disposal plant was being constructed. The factory was shut down on that day on account of changes being made in the drainage at the pumping manhole.

At the time of the last visit on November 9, 1914, the disposal plant had been constructed and placed in use although no wastes were then being discharged since the factory was practically shut down until the new grape juice was ready to be rebottled.

The effluent from the disposal plant flows directly into Chautauqua creek. This creek above the point of discharge of the effluent has a drainage area of about 33½ square miles consisting mostly of hilly country with the low lands under cultivation. The flow of water in the creek at the time of the first visit was about 2 cubic feet per second as determined at the sewage disposal plant. This flow is equivalent to about .06 cubic feet per second per square mile. The average wastes from the factory, as stated above, is about 33,000 gallons per day, while during the pressing season the flow may be two or three times as much. During periods of low flow, the wastes are ordinarily diluted with about forty times their volume of creek water, whereas during periods of maximum wastes discharge the dilution would only be about one-third as great.

Description of disposal works

The disposal works consist of a receiving manhole containing a pump, 1,900 feet of 8-inch vitrified pipe and a subsurface gravel bed. The receiving manhole is located at the factory and the subsurface gravel bed is on the east bank of the creek.

The wastes enter the receiving manhole about 14 feet below the surface of the ground and are then raised by a pump to an 8-inch gravity pipe line leading to the gravel bed or filter. This filter consists of about 300 feet of tile pipe, having open joints, laid about one foot below the surface of the gravel. The mean level of the water in the creek is about 4 feet below the surface of the gravel. The gravel bed is about 50 feet by 100 feet in size and has an area of about 5,000 square feet or .11 of an acre. Under average conditions of flow of the trade wastes the rate of application would be about 300,000 gallons per acre per day while under the maximum flow the rates would be two or three times as much. These rates are many times in excess of those at which a filter of this kind should be operated to provide adequate treatment, especially in treating a waste in which there is considerable suspended matter.

On the surface of the gravel could be plainly seen several lines of black sludge apparently leading from temporary holes in the surface over the pipes in the creek. At the time of the inspection these holes had been filled up and no indications of any wastes could be seen flowing from the plant.

No samples of the wastes from the factory could be taken at either of the inspections since there were no wastes being discharged, but at both inspections tests were made of wastes from the Welch Grape Juice Co. factory and the results of the tests of raw wastes will be included in this report since their wastes are undoubtedly similar in character during the same periods of operation.

The test of August 4, 1914 when the wastes consisted of sediment from large bottles and washings of bottles, utensils and floors was as follows:

Oxygen consumed, 10 minutes boiling, 76 parts per million.

Putrescibility test gave a stability of 3½ days.

Tests of November 9, 1914, in which the wastes consisted of washing of the pressing cloths and general cleaning up of the utensils and plant are given in the following table:

	Parts Per Million		Imhoff cone c. c. in one hour
	Turbidity	Oxygen consumed, 10 minutes boiling	
Raw wastes as received at disposal plant	900	....	1.1
Raw wastes as received at disposal plant — Clear portion after two hours in Imhoff cone	....	540	....
Raw wastes as received at disposal plant — Filtrate through filter paper	....	420	....
Clear portion of raw wastes as received at plant after two hours settling in Imhoff cone and after precipitation	Clear	98 to 104	....

While the character of the trade wastes as determined by either test may not represent the average wastes, it is thought that they do represent approximately the wastes at these seasons of the year. The wastes collected on August 4 probably represent the wastes during the greater portion of the year. The character of the wastes as determined by the tests of November 9, 1914 may be described as follows:

The turbidity amounted to 900 parts, which was chiefly caused by the large amount of finely divided matter in suspension and this material did not readily settle. In the Imhoff cone test 1½ cu. centimeters of sludge was obtained in one hour. In the oxygen consumed test of the supernatant portion of the wastes after they had been standing two hours 540 parts per million were indicated. This determination indicated a strength of at least five times the strength of the average day flow of domestic sewage. After passing this settled waste through filtering paper the oxygen consumed test gave 420 parts, showing a reduction of 22 per cent of organic matter. This small percentage of removal plainly indicated that the greater part of the organic matter was in solution or in a very finely divided condition and in suspension so that it was not removed by settlement or by filtration through filter paper.

In view of the character of the wastes with its high turbidity and organic content and of the small percentage of purification upon passing the settled wastes through filter paper, tests were made of the settled wastes to determine if the process of chemical precipitation could be used and to compare its efficiency with plain sedimentation. These tests were made in the field, the principal object being to see if a good percentage of clarification and removal of organic matter could be obtained rather than to determine the amount of chemicals required. The supernatant wastes after standing two hours were used in the tests.

In one test 20.3 grains of lime and 69 grains of alum per gallon of wastes gave a reduction in oxygen consumed from 540 parts in the settled wastes to 104 parts in the settled treated wastes. This reduction represented a removal of about 81 per cent of the organic matter. The sugar remaining in the wastes probably accounted for a large part of the 104 parts in the treated wastes. In another test 30.5 grains of lime and 138 grains of copperas per gallon reduced the oxygen consumed from 540 parts to 98 parts and represented a removal of 82 per cent of the organic matter. Both tests gave a clear effluent in which there remained a very slight amount of color.

These amounts of chemicals are greater than are ordinarily used in chemical precipitation plants and it is probable that the quantities could be reduced considerably and still give a satisfactory effluent. With good settling and screening at all times of the year the amount necessary could probably be reduced. For the greater part of the year the amount of chemicals required would probably be one-third to one-tenth of the amount necessary during the pressing and cleaning seasons.

Summary and conclusions

As a result then, of the investigation of this plant and after careful consideration of the capacity of the plant to treat the wastes of a grape juice factory and of certain studies and tests made with respect to chemical precipitation, the following summary and conclusions have been reached:

1. The subsuface gravel filter is not a proper type, design or capacity to treat the wastes from the factory, especially with the large amount of organic matter present, a large part of which is in solution or is in a fairly divided state.
2. As a result of the plant being unable to properly treat the trade wastes at all times the raw wastes were apparently allowed to pass through open ends of some of the drain pipes and flow directly to the creek thereby causing an offensive and objectionable condition.
3. The construction and operation of the disposal plant is a violation of the Public Health Law since the plans for the same were not approved by this Department.

4. In case filters are to be used in the treatment of the wastes efficient settling and screening should be provided in order that as much as practicable of the suspended matter be removed and the load on the filters thus reduced.

5. The results of the chemical precipitation tests indicated that this method is far more efficient than plain sedimentation and that this treatment whether alone or with filtration might prove to be the more satisfactory solution of the problem of waste disposal at the factory.

6. Owing to the large amount of sugar present in the wastes and the fermentative character of the same it is not possible to state at this time whether biological treatment in filters would be a practicable and effective method of treatment.

Recommendations

In view of the insufficient size and unsatisfactory operation of the plant resulting in the raw wastes being discharged into the creek and since the construction of the plant was unauthorized by this Department, I recommend that Armour & Co. be required to proceed at once to alter, reconstruct or otherwise install a waste disposal plant of such type and design as will produce an effluent which will remove the objectionable conditions which are due to the operation of the present plant. The plans for the disposal plant should first be submitted to this Department for approval. The question as to what type of plant shall be adopted is one that will, no doubt, require the study of a competent expert in this field, and it is essential that before Armour & Co. install a plant they employ such an expert to study the problem, and advise them as to the most practical method to adopt.

Respectfully submitted,

THEODORE HORTON,
Chief Engineer

ALBANY, N. Y., *April* 22, 1915